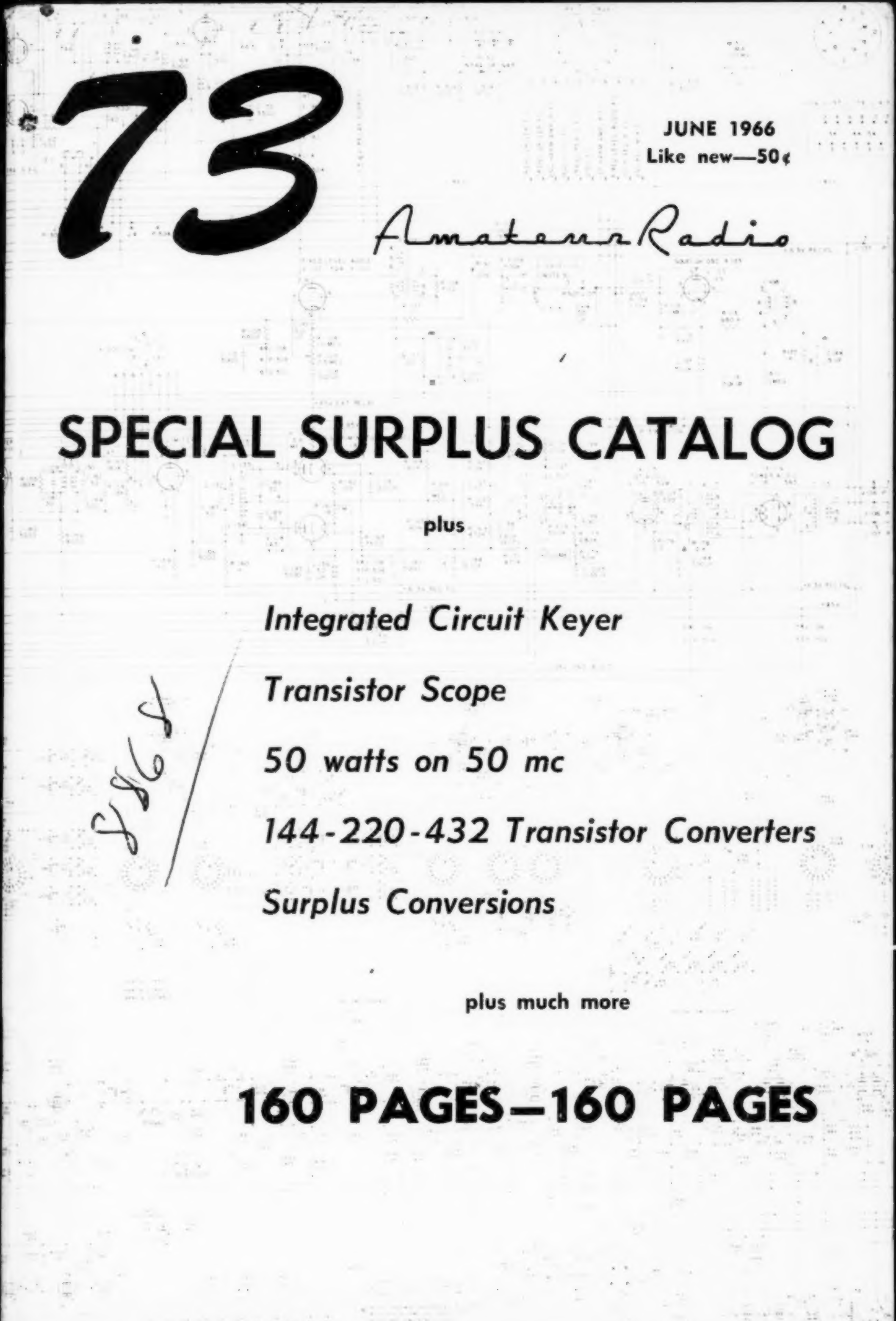

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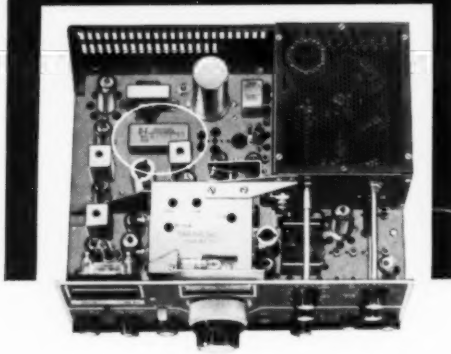

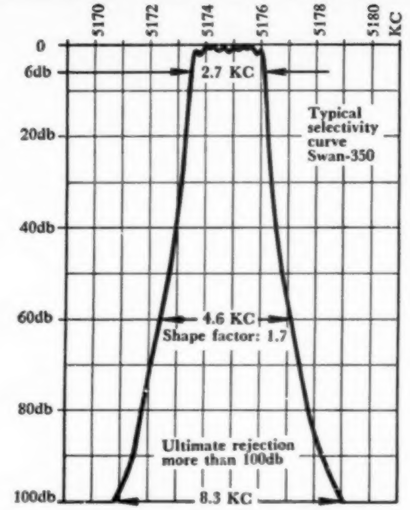

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Oceanside, California

73 Magazine

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June 1966

Vol. XXXIX, No. 1

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de W2NSD/1

never say die

My little African safari has expanded a bit. We will now go on a three week hunting safari in August, followed by a three week drive through Kenya, Uganda, Congo, Ruanda, Burundi and Tanzania. From there the air fare is only a little more so we will continue to Lebanon, Syria, Iraq, Iran, Afghanistan, India, Burma, Thailand, Malaya, Bali, New Guinea, Australia, New Zealand, Fiji, Samoa, Tahiti, and back to the U.S. We figure the whole trip for a bit over eight weeks and to run about $2500. We can probably squeeze one more aboard if anyone is interested . . . which I realize is unlikely.

A Walk in the Black Forest

Like millions of others, I've become somewhat addicted to the Tijuana Brass. One of my favorite selections is A Walk In The Black Forest. Did you ever?

I found myself remembering my last trip to Germany and the Black Forest. I was on my way from Stuttgart down to Zurich to visit the moonbouncers HB9RF and HB9RG. The road down there is a fairly narrow winding black top with places every few miles to pull off and park for a picnic or just a short jaunt through the woods. They keep their forests cleaned out of underbrush and you can walk easily for miles if you wish without struggling through bushes and spider webs like we have in our New Hampshire woods.

My arrival in Zurich was a little later than I expected due to a prolonged luxurious rest stop in a beautiful glade. I sat listening to the Schwartzwald music on the FM radio while eating some very black bread and German sausage, washed down by a small bottle of apfelsaft. New Hampshire and 73 seemed a world away. It was nice to relax after several days of furious activity.

A few days earlier I had flown to London for a short visit with the fellows at RSGB. Bus to town, taxi to Little Russell Street, lunch, taxi to airport, and quickly aboard a United Arab Airlines plane for Frankfort. Whew!

Johnny Barrows DL4HU, Lee Forest DL-4LZ and Ed Pahl DL4UL met me at the airport in Frankfort. Johnny was an old friend. We'd corresponded for several years trying to get reciprocal licensing through, only to be thwarted time after time by the ARRL. It is interesting that the League now is taking credit for reciprocal licensing. Oh well. I'd met Johnny when I'd visited the Bitburg club a couple of years earlier.

The airline had managed to lose my bag and it took the four of us a half hour, with the help of Lufthansa to get them to carefully recheck their plane. Sure enough, there was my bag over behind some freight that had just been loaded aboard. I almost lost it for good for I understand that that plane crashed on its way to Cairo after leaving me.

That night Johnny and I kept a sked at one of the great restaurants in Frankfort with Peter HB9PL from Basle. I had made the date on twenty meters a week earlier and it came off smoothly. It was one of those splurge dinners you have once a year (at most) with venison and all the trimmings.

The next day I picked up a Volkswagen 1500S Variant, which I had ordered ahead.

That night I attended a dinner meeting of the newly formed German-American Amateur Radio Club and found nearly a hundred on hand. It was interesting for me to find that this group so far from the U.S. knew more about what was going on than most groups right here in the States. They certainly asked excellent questions.

(Continued on page 151)

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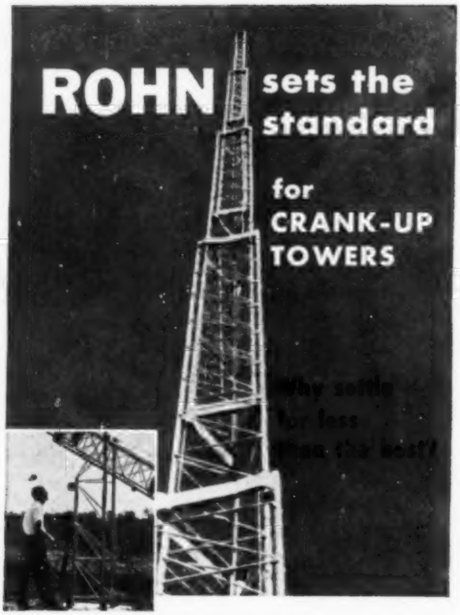

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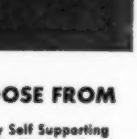

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Editor's Ramblings

Zip

Mail delivery in the U.S. seems to be at its slowest ebb yet. Service is terrible. It takes as long as three weeks for second class mail to reach the west coast from our printer in Connecticut, and even air mail often takes as long as three or four days. But we have been assured by the Postmaster General, L. O'Brien, that service *will* improve. For instance, he proposes a new class of priority mail to replace air mail and first class. This new class will cost about 7¢, and should provide one day delivery anywhere in the country, certainly a reasonable goal.

Another improvement the post office is working on is increased automation. To help with this, they have divided the country into small districts, each with a zip code. All bulk mail users and magazines must use zip codes on their mass mailings after December 31, 1966. Most of our renewals are including their zip codes, but we still have many stencils in our lists of subscribers without zips. We have to add the code—a very expensive and time consuming operation—so please help us out a little. Please check the address on the wrapper in which you receive this 73. If it doesn't contain your zip code, or if the zip is wrong, please write the number on the wrapper and send it along to Linda, c/o 73, Peterborough, N.H. 03458. Incidentally, if you will be renewing soon, you can just wait and include the zip then. Please include your zip on all new subscriptions and renewals.

While it's hard to estimate how much right now, this process is going to cost us plenty. We can only hope that we'll be rewarded for the expenditure with decent mail service.

Club special

Ham club secretaries, presidents and editors should make sure that they send us their addresses so that we can tell them about our special plan for club members. It offers a very low price on subscriptions, prizes, and a number of other small benefits such as the background papers that Wayne sends out every once in a while.

. . . Paul

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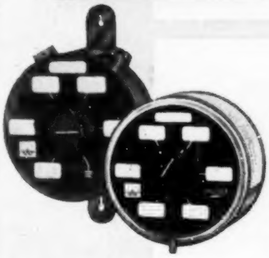

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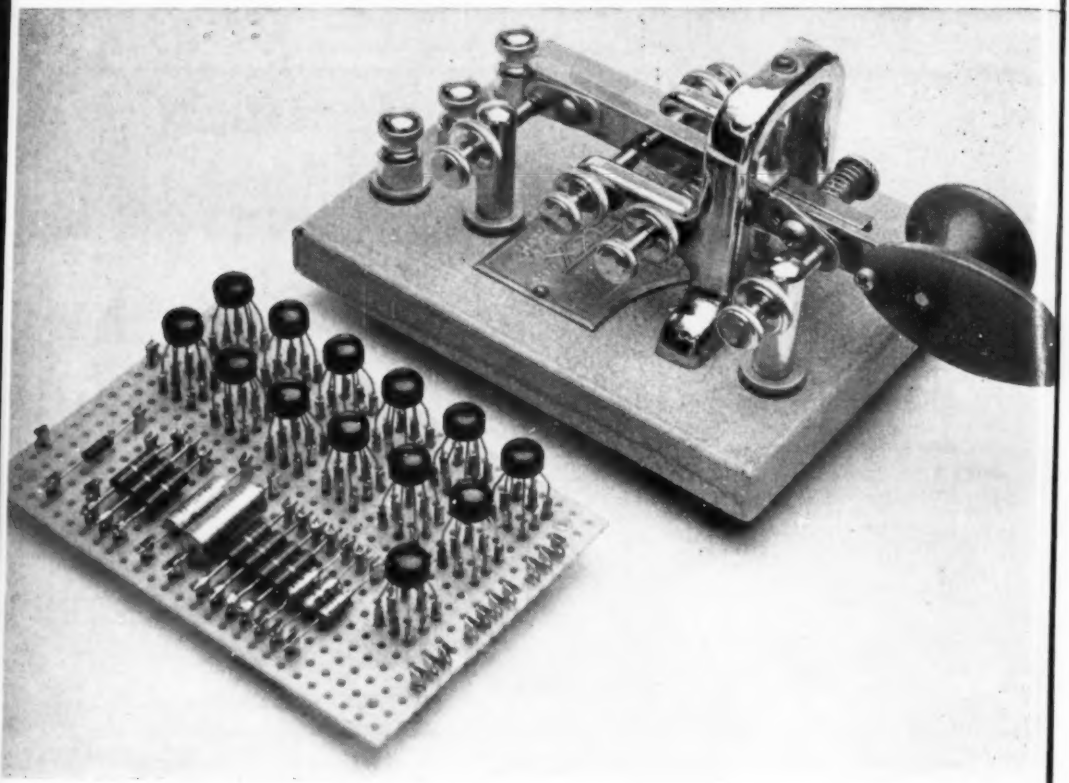


Thomas Pickering W1CFW
991 Middle Road
Portsmouth, R. I. 02871

The Micro-Ultimatic

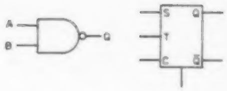
Integrated circuits in a high-performance electronic keyer

One of the most popular amateur projects over the years has been the automatic keyer. The lever-operated types have ranged from simple capacitor-relay types to the rather complex "Ultimatic".(1) An entirely new concept in keyer simplicity is now available to the amateur in the form of integrated circuits. The Micro-Ultimatic employs IC's in a keyer or extreme stability and reliability, coupled with the ease of operation resulting from the separate dot and dash memories, as in the original Ultimatic. Best of all, the cost for the IC's is about $35.00. To duplicate the circuit using discrete components would require about 110 transistors and a basket of other parts.

It is the intent of this article not only to describe the Micro-Ultimatic but also to provide a primer on simple logic systems and how they can be put together with the type of IC used in the keyer. Thus, you should be able to generate lots of ideas for gadgets which use IC's, and cheaply, at that.

The impact of integrated circuits on the electronics industry has been nothing less than astonishing. IC's have already obsoleted the discrete-component logic circuits in computers and military equipment, and they will soon be found in consumer items and even toys. These digital integrated circuits are a natural for an electronic keyer.

Most of the large semiconductor manufacturers are making IC's. These vary widely in type and price, but most are based on fabrication techniques which put a complete operating circuit with transistors, diodes, resistors and capacitors on a single silicon substrate, and in extremely small physical size. The circuits are made in large batches, sliced apart, and packaged. Packages are typically the "flat-pack," the TO-5 can, or, lately the epoxy encapsulated "pill" similar to the TO-5 shape. These are less costly than the sealed metal cans. The means by which logic functions are performed in each complete circuit or "chip" varies and includes RTL (resistor-transistor logic), DTL (diode-transistor logic), TTL (transistor-transistor logic) and others. Each type has its own electrical characteristics with regard to power consumption, speed, driving power, and cost. But each performs some simple logic function, regardless of how it is accomplished on the chip. The epoxy RTL now made by Fairchild and packaged in the TO-5 type "cans" is the lowest in cost of any IC logic known to the author at present. That's the principal reason for its use in the Micro-Ultimatic. The logic line is available from many distributors (discussed later).



(a) NAND GATE (b) FLIP-FLOP

Fig. 1. Functional symbols of two logic blocks. Bottom lead of the flip-flop is P.

About binary systems

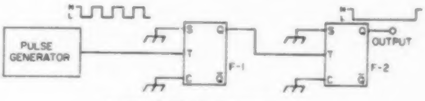
Since the digital IC is a complete logic package we don't really have to know what goes on inside in order to assemble a system. So first, let's quickly review the fundamentals of a binary digital system.

A binary system is one in which there are only two recognized states. In a typical electronic system, a voltage is associated with each of these states. The states, or levels, are variously called "true" and "false," "1" and "0," "high" and "low," etc. We may choose the terms we want to use. For our purposes here, the terms "high" and "low," I think, help convey more of a physical meaning, since we can associate each with a voltage, one high and one low.

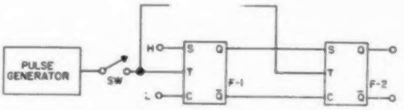
At any instant of time in a binary system the state at any point is either high or low. If it is not one, it is the other. Here we ignore the quite practical fact that in a real-life system some high states may be higher than others. Further, the state at some point in a system is usually the result of the states of one or more points elsewhere in the system. The exact relation between the inputs and outputs of one block of the system is frequently expressed by Boolean algebra, but we can understand the concept by other means.

The NAND Gate

A very useful logic block in a system is the NAND gate. It can be represented func-



(a) TWO-STAGE BINARY COUNTER



(b) TWO-STAGE SHIFT REGISTER

Fig. 2. Two common applications of JK flip-flop.

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(1) Kaye, "The All-Electronic 'Ultimatic' Keyer," **QST**, April, 1955.

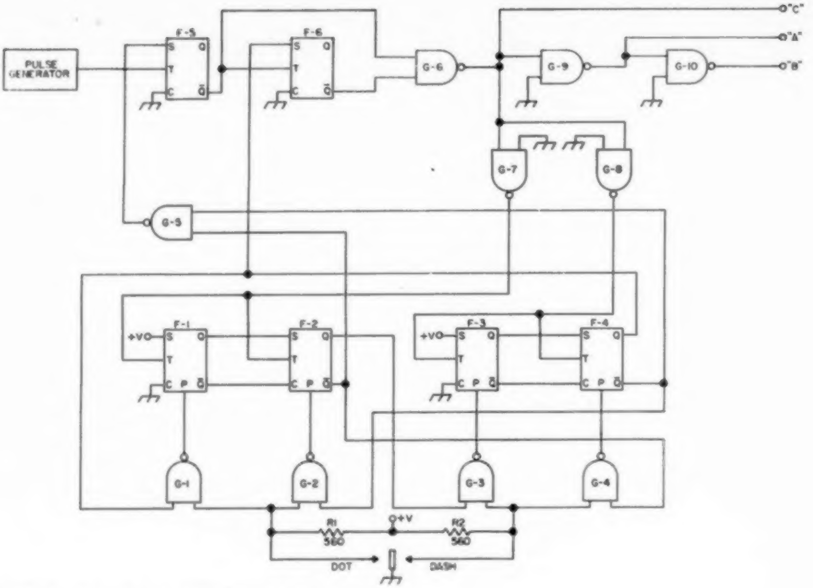

Fig. 3. Block diagram of the Micro-Ultimatic.

tionally as shown in **Fig. 1(a)**. The output Q is related to the inputs A and B in a manner which is readily shown in a truth table. This is a table which expresses all possible combinations of output and input states for the logic block considered. Here is the truth table for a NAND gate:*

A	B	Q
L	L	H
L	H	L
H	L	L
H	H	L

(H = high; L = low)

The table shows that the output of this gate is high (H) only if both inputs are low (L). Any other input combinations result in a L output. We have chosen the NAND gate for this example because this is the gate used in the Micro-Ultimatic. Note that if we permanently connect one input to L, the gate becomes an inverter, whose output is always the complement (or inverse) of its input. This connection eliminates the last two rows of the truth table. The remaining two rows show B and Q to be in inverse relationship. By combining NAND gates, complex systems can be formed; in fact, an entire computer can be built from combinations of this logic block.

The Flip-Flop

If one of the inputs to **Fig. 1(a)** changes, the output may change. The *time* required for this change is considered to be zero in theory. Thus the NAND gate does not possess memory. The memory or storage function is performed by a flip-flop. We will restrict our discussion to the type of FF used in the keyer. Its functional diagram is in **Fig. 1(b)**. The FF has two outputs, Q and $\overline{Q}$. $\overline{Q}$ is simply the complement of Q. If one is high, the other is low. Q is the nominal output of the flip-flop; $\overline{Q}$ is the inverted output. In the keyer analysis which follows, when we speak of the state of the FF, we mean the state of Q. Input pulses from a clock or other sources are normally applied to the T (trigger) terminal. The state of Q after the

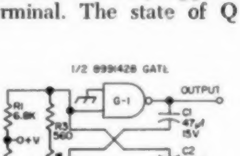

Fig. 4. Schematic of the pulse generator.

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*The purist would also point out that this is the truth table of a NOR gate or a NAND gate. We will not go into that here.

trigger depends on the states of the S (set) and C (clear) inputs at the time of the trigger. In other words, the trigger can cause a change in Q; S and C determine what the change will be. Q remains in the new state until another trigger pulse is applied. We may set up a truth table for the FF, as follows:

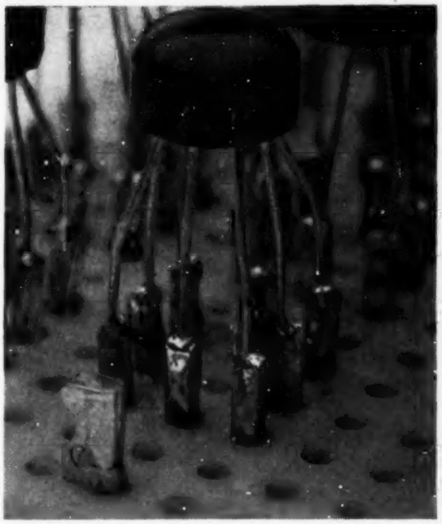
(Before Trigger)		(After Trigger)
S	C	Q
H	L	H
L	H	L
L	L	Reverses
H	H	No change

The response of the FF to the trigger thus depends entirely upon the S and C inputs prior to the trigger. Note that connecting S and C to low causes the FF to reverse its state on each trigger pulse. This type of FF is known as a JK flip-flop, and the S and C leads are sometimes called the J and K leads. **Fig. 1(b)** also shows a P lead. This is for presetting the FF; a high level applied at P will make Q low.

Two common uses to which the JK flip-flop is put are as a binary counter element and as a shift register element. **Fig. 2(a)** is a two-stage counter consisting of two FF elements and a source of pulses. By connecting the S and C leads of F-1 and F-2 to low (ground) the output of each FF reverses each time its input signal makes a transition from high to low. This is as shown in the truth table above. In **Fig. 2(a)** the F-2 output frequency is at ¼ the input pulse rate. More stages can be added for further frequency division. This FF application is used in character generation in the Micro-Ultimatic.

The second common FF application is also employed in the keyer. It is the shift register, shown in **Fig. 2(b).** Assume both F-1 and F-2 are low; that is, the Q lead of each is low. Note that the S and C leads of F-1 are connected to high and low respectively. When the switch is closed, the first H-L transition from the pulse source will flip F-1, leaving it high; F-2 will remain low, since its S lead was connected to the output F-1 (low) before the trigger. After the second pulse, however, F-2 will flip to high in response to the H input on its S lead. If more stages were added the H output would propagate down the line, one stage per clock pulse. The shift register thus acts as a sort of scanning device, or multiple-position switch. The output of the last stage can be tied to the input of the first for use as a re-entrant shift register or ring counter.

We have reviewed a little elementary binary logic and looked at the two logic element types used in the keyer. Now we can discuss keyer operation. First, let's define a few terms:

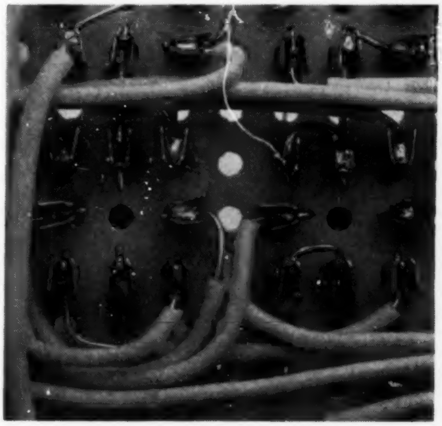


Details of clip mounting. Clips for IC's are mounted upside down.

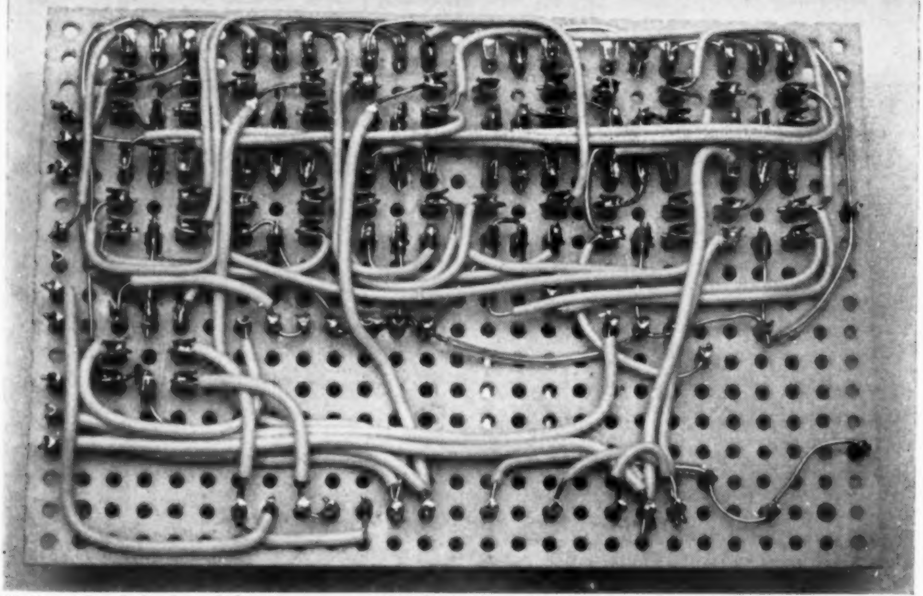
Logic States:	H (high) = 3 volts. L (low) = 0 volts.
Flip-Flops:	FF is SET if Q is low. FF is CLEARED if Q is high.
Trigger:	A high-to-low transition.

Operation of the Micro-Ultimatic

A block diagram of the keyer is shown in **Fig. 3.** Actually this is almost the schematic



Close-up of wiring side of board.

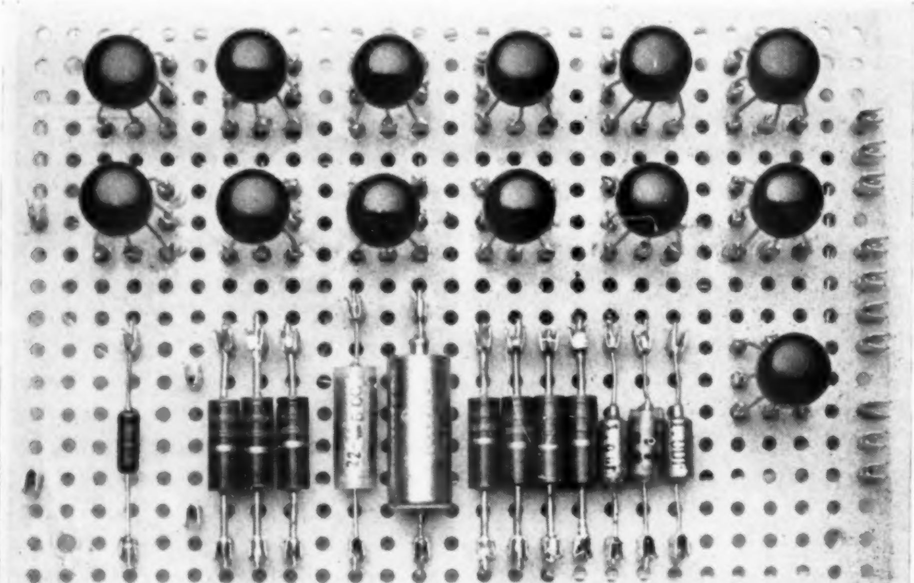


Wiring side of the board. Lay in power wiring first, then signal wiring. A printed circuit board might make things look a little neater.

since most of the discrete components are gone. A few are required for the pulse generator, described later. The character generators are F-5 and F-6, a two-stage binary counter. F-1 and F-2 are a two-stage shift register as are F-3 and F-4. G-9 and G-10 are two gates wired as inverters. They provide two complementary outputs so that either mark or space can be high or low, as subsequent circuitry requires.

In the idle state all flip-flops are cleared. This means that G-5 has L on both its inputs; its output is H, preventing F-5 from toggling in response to the pulse generator which runs continuously for accurate character formation. This method, by the way, produces precise dot-space ratios of unity, regardless of speed. One side of G-1, G-2, G-3, and G-4 is at H level due to the connections to +V through R_1 and R_2. G-1 also has another H input due to F-4; G-3 has another H input due to F-2.

Top of board. IC's are, left to right (top row) G-5/G-6, F-5, F-6, G-1/G-2, G-3/G-4, G-9/G-10. Bottom row, Pulse Generator, G-7/G-8, F-1, F-2, F-3, F-4. Monitor IC is in lower right.



G-2 and G-4, however, each have an L input on one leg. If the key paddle is moved to dots, G-2 will see L on both inputs. Its output will become H, setting F-2, which then applies H to one side of G-5 which then applies L to the Set lead on F-5. The next clock pulse will flip F-5 to the Set condition. This causes G-6 output to go low, driving output A up to high and B to low, initiating a dot. G-7 and G-8 outputs are now at H level, feeding the T inputs of F-1, F-2, F3 and F-4. When the next clock pulse arrives, F-5 will be cleared, the keyer output will revert to idle, and the G-7/G-8 outputs will drop to L. This transition will clear F-2, since its S and C leads were at H and L respectively, due to F-1. The dot is now complete. Nothing else can happen in the character generators until the next clock pulse. If the paddle had been held to dots, F-2 would have remained set and dots would have continued.

To generate a dash, tap the lever to the dash side, setting F-4. G-5 output drops to L permitting F-5 to toggle, as before. However, F-4 has now applied L to the S input on F-6, and after the second clock pulse clears F-5, the H-L transition on the $\overline{Q}$ output of F-5 toggles F-6 to continue the mark condition. Two more clock pulses will leave both F-5 and F-6 cleared, and F-4 will clear as the G-7/G-8 output falls to L. The dash is thus complete.

The description so far is that of a complete keyer, although F-1 and F-3 have not been used. In fact these two may be deleted, along with G-1 and G-3 and you still have a keyer. F-1 and F-3 provide the dot and dash memory. These are extremely useful at moderate and high speeds. When sending letters with a terminal dot, such as N, C, F, etc., it is easy to miss that final dot unless you are there with the paddle at the right time. The dot memory takes care of this for you. As soon as the final dash of the C (for example) is on the air you may tap the paddle quickly to the dot side. The keyer will complete the dash and then add the dot. In fact, you can make the dot movement during the space between the dash and the final dot. Operation at low speed demonstrates this. With the speed pot at minimum, quickly flip paddle from dash to dot and let go. If your action occurred during the interval between clock pulses, you may even have released the paddle before the character starts. A perfect N comes out, regardless. Once you use the dot memory it will be hard to see why more keyers don't employ it. The dash memory serves a similar purpose on letters with a terminal dash. If you have separate dot and dash paddle switches, the memories become even more useful. See reference (1).

Operation of the dot memory is as follows: Tap the paddle quickly from dash to dot. F-4 will be set first. However, instead of setting F-2 on the dot side, F-1, the dot memory will be set, since F-4 applied H to G-2 and L to G-1. F-4 will cause a dash to go on the air, as usual. When it is complete, the shift-register action of F-1/F-2 will shift the L from F-1 into F-2, leaving the keyer in the dot-generating state. The dot will go on the air, after which F-2 will be cleared. A similar action takes place in the dash memory on letters such as A, K, Q, etc.

The pulse generator

Almost any pulse generator may be used, but in an effort to keep the keyer on an all-IC basis, a simple astable multivibrator was selected. It consists of a dual 2-input gate, wired as shown in **Fig. 4.** R_3 limits top speed. The speed range is about 8 to 45 WPM. It would be better to use a log pot for R_4, since the resistance-speed relation is quite non-linear. To increase the top speed, R_3 may be slightly reduced.

Output circuits

Select the output circuit suitable for the transmitter being keyed. **Fig. 5** shows three circuits which should suit your individual requirements. Since the keyer generates a perfect mark-space ratio, it seems a shame to upset this by using a relay unless it is fast. Circuit (a) is suitable for cathode keying. Measure the key-up cathode voltage and select Q_1 for a V_{ceo} not les than this value. The cathode current should not exceed about $2h_{FE}$ milliamperes, where h_{FE} is the d-c current gain of Q_1 at the desired cathode current. For keying low-voltage VFOs and crystal oscillators, it's unlikely that the current will exceed 10 ma. If you are still keying things like 6L6's circuit (c) may be better, since the key-up voltage in such tubes may run well over 100 volts. Some transistors suitable for Q_1 are the 2N3402, 3414, 3845-A (all 25 volts V_{ceo}), and the 2N3404 and 3416 (50 volts V_{ceo}). These are inexpensive GE types. There are lots of others. Use a low-leakage silicon type.

For keying a negative lead to ground, such as in a blocked-grid system, the keyed voltage is again the important item. A PNP transistor must be used, and **Fig. 5 (b)** is appropriate. Q_2 must be a germanium type and CR_1 must be silicon. R_1-CR_1 form a bleeder circuit from

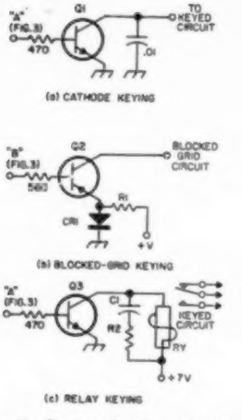


Fig. 5. Output keying circuits.

the +V supply which keeps the emitter of Q_2 at about +0.75 volts. Input to Q_2 is taken from the "B" output of **Fig. 3**, so that in the space condition Q_2 is reverse-biased and no current flows in the keyed circuit. When "B" goes to ground during mark, the forward emitter-base voltage provided by CR_1 is sufficient to turn on Q_2. Actually, the blocked-grid line will be pulled up a bit past ground, to about +0.5 volts, but this should be no problem. Choose Q_2 for a V_{ceo} not less than the keyed line voltage. R_1 is determined by the keyed current. For a current of 10 ma, R_1 should be about 220 ohms. Nearly all the keyed current flows through R_1, and its value should be such as to produce no more than about 2.2 volts drop. This same current flows out of the +V supply and therefore represents an additional drain which must be considered. There are many transistors suitable for Q_2. If the keyed voltage does not exceed 40 volts, the 2N404-A is satisfactory. For keyed voltages under 25 volts, choose any germanium PNP with an h_{FE} of over 25 and V_{ceo} of 25 volts. For voltages up to about 100, the 2N398 is recommended, although the keyed current may be limited by the lower h_{FE} (20) of this type.

For situations requiring a relay, **Fig. 5(c)** is appropriate. Few relays known to the author will operate fast on a 3.6 volt supply, so take the relay voltage from the point shown on the power supply schematic. This will be about 7 volts and should handle a small relay such as the Sigma 4F-1000 type. Q_3 should have a V_{ceo} of around 25 volts. Suggestions for Q_3 are the same as those for Q_1 above. It is advisable to protect Q_3 against inductive transients by the C_1-R_2 network shown. The values will depend upon the relay used.

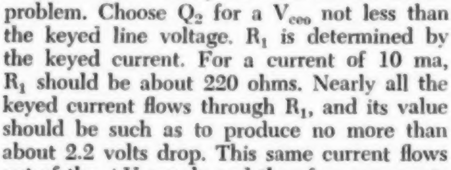


Fig. 6. Power supply schematic.

Power supply

Collector supply requirements for the Fairchild IC's is quoted as +3.6 volts ±10%. The keyer performs well at less than 3.0 volts at room temperature, and were it not for the 120 ma current drain, a pair of flashlight batteries would be ideal. A simple ac supply is shown in **Fig. 6.** The current drain is nearly constant under mark or space condition, so load regulation is not required. The 3.6 volt zener is highly recommended as protection to the IC's against line voltage surges. Zener current should be set to about 20 ma by adjusting R_1 under load. If the supply is run without a load, the zener may overheat.

Monitor oscillator

A simple monitor may be incorporated in the keyer, using the circuit of **Fig. 7.** This is nearly identical to the pulse generator except for time constants. The output is a stout square wave of about 3 volts peak-to-peak and gives ample headphone volume. Control of the monitor is taken from "C" and "B" of **Fig. 3.** These two leads are in phase opposition; one is high when the other is low. Their alterations cause the monitor oscillator to start and stop in accordance with the transmitted signals.

Construction

Since only two types of IC's are used in the keyer, you can convert **Fig. 3** into a schematic, knowing the pin connections to the IC cans. They are shown in **Fig. 8.** Since there are two gates per can, I suggest you combine the gates in the following manner: G-5/G-6, G-7/G-8, G-9/G-10, G-1/G-3, and G-2/G-4. The pulse generator and the monitor oscillator each require a whole can. The keyer is mounted on a piece of Vectorboard about 4 x 2¾ inches. This is cut from the sheet at a 45-degree angle to produce a square hole pattern with holes on 0.141-inch centers. The IC mounting is made easier. Eight clips are used for each IC. Clips are arranged in a square, two holes on a side. Insert clips from the bottom of the board to simplify soldering in the IC's after all wiring below is complete.

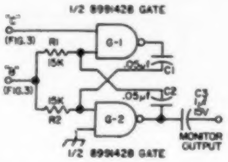


Fig. 7. Schematic of monitor oscillator.

Clips for discrete components are mounted in the usual manner. If you want to try for PC board mounting, go ahead, but I think you will need a double-sided board. A note on wiring: The clip spacing is small and there's little room to work. Wiring is a bit easier if you use #24 or #26 tinned wire and slip some sleeving over each lead as it is wired. Don't forget the power wiring! Pin 8 of every can goes to +V; pin 4 to ground. After all wiring is completed, turn the board over, clamp it in place and solder the IC's in, after first pre-tinning each clip. Hold each IC lead in turn with tweezers while soldering. There are 104 such connections; don't rush the job. Ground pin 6 to F-5 and F-6.

Sources for the IC's

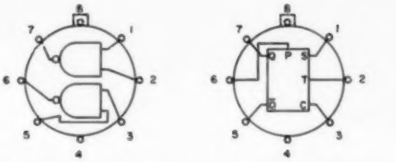
For reasons unknown to me, some of the major suppliers do not seem to handle Fairchild semiconductors. However, other distributors do. The quoted small-quantity prices are $3.95 each for the Flip-Flop and $1.65 each for the gates. To order, specify Fairchild JK Flip-Flop, type UX8992328X. The gate is the Dual 2-input gate, type UX8991428X. A letter to Fairchild Semiconductor, 313 Fairchild Drive, Mountain View, California will get you a list of distributors who stock the IC's.

Simplified keyer

If you don't want the memories the cost goes down a bit. Simply omit F-1, F-3, G-1, and G-3. Tie the F-2 and F-4 Set inputs to +V and the Clear inputs to ground. If you want to eliminate only the dash memory, omit F-3. Disconnect G-3, but G-1, in the same can, is still required. These simplifications will reduce power supply load and you will have to readjust R_1 of **Fig. 6**.

Some final comments

The current through the key paddle is on the order of 400 microamperes. At this low level it is essential that the key contacts are kept clean, and further, that the continuity between system ground and the key lever be kept constant. This circuit may include a bearing and if a flexible jumper does not bypass this bearing there can be erratic operation. Some of the key paddles designed for use with electronic keyers have considered this problem; others have not.



(a) 8991428 DUAL 2-INPUT GATE

(b) 8992328 JK FLIP-FLOP

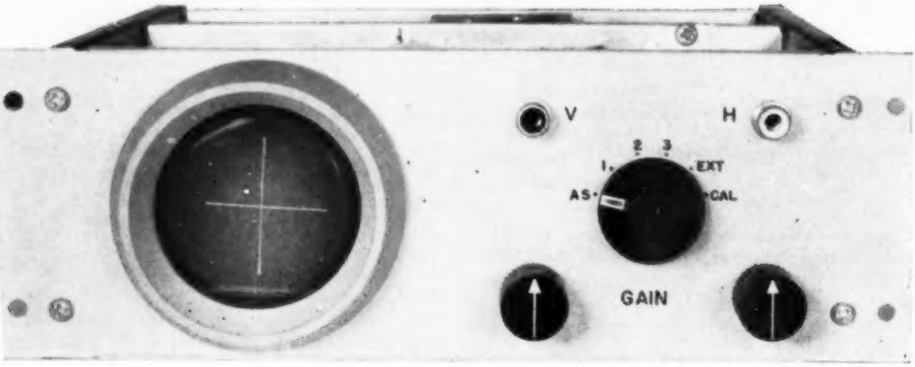
Fig. 8. Bottom view of Fairchild gate and flip-flop IC's. Note: Pin 8 of all modules goes to +3.6 volts; pin 4 to ground.

Trouble shooting if required, is simple. An ordinary multimeter may be used effectively. When a circuit point is supposed to be low, it should read not more than about +0.18 volts. High level may be anywhere between about +0.95 volts and the full supply, depending on circuit loading. The use of a shielded enclosure is strongly recommended. These logic circuits are extremely fast, and only a hundred millivolts of RF may be sufficient to send the keyer on a wild generating spree. The ordinary aluminum box is quite effective. The use of a pair of 0.01 µf discs at the dot and dash input terminals is useful in case of stray RF. Also, use a small bypass in the output wire to the external circuit. If erratic dash operation is observed but with normal dot generation and memory, connect a 100 pf disc between the output of G-6 and ground. This reduces the very small spike which may result during dash generation when F-5 goes high, triggering F-6 to low. If the spike reaches F-4, it will clear it and terminate the dash.

The IC's used here are specified by Fairchild for operation between 15° and 55° Centigrade (59 to 131 degrees F). The keyer dissipates very little heat by itself (about 450 milliwatts), but the effect of heat generating equipment nearby should be considered.

The Micro-Ultimatic is designed to comply with the loading rules specified for the IC's used; therefore, it may be expected to show the reliability of operation associated with integrated circuits. The author's keyer has been running continuously for four months without a sign of problems. This is the eleventh type of keyer which I've built and it's a honey, the smoothest running and most dependable keyer yet. The real test comes during a contest, and this keyer leaves nothing to be desired.

. . . W1CFW



Tom Lamb K8ERV
1066 Larchwood Rd.
Mansfield, Ohio

A Transistorized Oscilloscope for RTTY

This simple scope used inexpensive high voltage transistors instead of conventional tube-type deflection amplifiers.

Teleprinter circuits are admirably suited for transistorization, as indicated by the number of recent transistor TU designs. These TU's have had to use meters or tuning eyes for tuning indicators due to the difficulty of designing scope deflection amplifiers.

This article will describe a simple (nearly) all transistor X-Y oscilloscope, designed for RTTY tuning, but suitable for general X-Y plotting and frequency comparison work. It incorporates a unique blanking circuit to dim any undeflected spot.

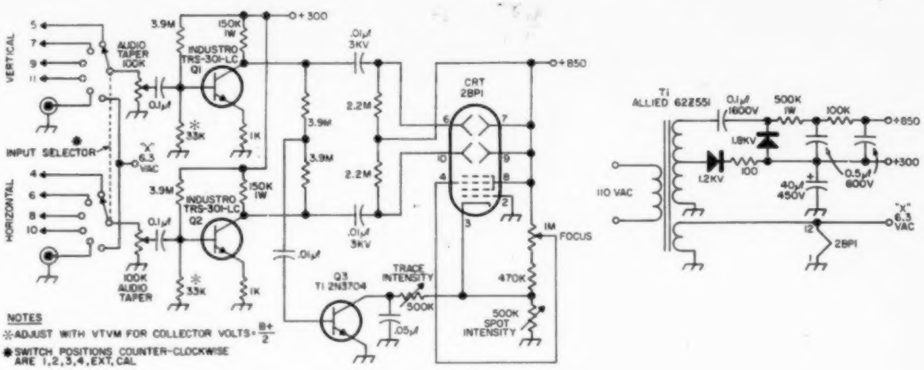
Cathode ray tubes require such large deflection voltages that transistor drivers have been uneconomical and unpractical. Recently several 300 volt silicon transistors have become available to reverse this situation. They are ideal for scope deflection amplifiers. The RCA 40264 ($1.21) uses a small diamond case, with non-standard leads. The Industro Transistor TRS-301-LC uses a standard TO-5 case and was used here. Either will work.

Tom, former W4OEY and W1SMY, is an electrical engineer (MSEE, MIT) for the Tappan Company; he designs microwave ranges. Tom has written many articles in 73, mostly on RTTY.

Amplifier

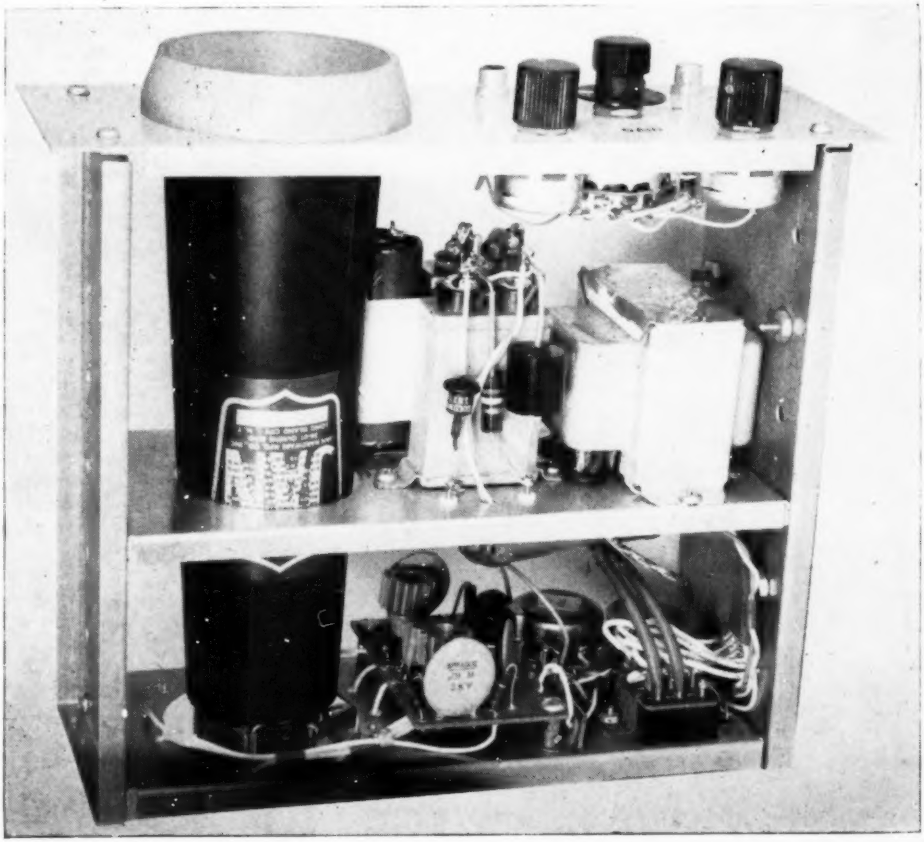
One of the photos shows an excellent 300 volt p-p sine wave at just below the amplifier's clipping level. This is enough voltage to deflect almost any 2, 3, or 5 inch CRT operated at moderate accelerating voltages.

The amplifiers are quite conventional except for the 300 volt B+. My particular scope obtained full deflection with inputs of only 0.3 volts (RMS) vertical and 0.5 volts horizontal. The input impedance varies with the gain

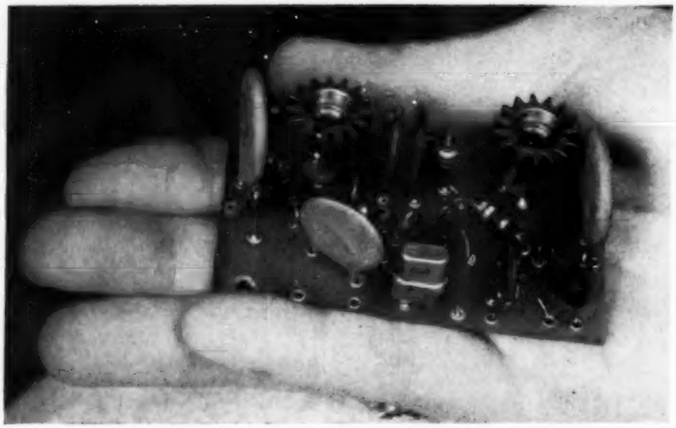


VERTICAL
5
7
9
11
AUDIO TAPER 100K
INPUT SELECTOR
"X" 6.3 VAC
HORIZONTAL
4
6
8
10
100K AUDIO TAPER
0.1µf
0.1µf
3.9M
150K 1W
INDUSTRO TRS-301-LC Q1
33K
1K
3.9M
150K 1W
INDUSTRO TRS-301-LC Q2
33K
1K
+300
.01µf 3KV
.01µf 3KV
2.2M
2.2M
3.9M
3.9M
.01µf
Q3 TI 2N3704
TRACE INTENSITY 500K
.05µf
CRT 2BP1
6
7
10
9
4
8
2
3
+850
1M FOCUS
470K
500K SPOT INTENSITY
NOTES
*ADJUST WITH VTVM FOR COLLECTOR VOLTS = B+/2
● SWITCH POSITIONS COUNTER-CLOCKWISE ARE 1,2,3,4,EXT,CAL
T1 ALLIED 62Z551
110 VAC
0.1µf 1600V
1.8KV
1.2KV
100
500K 1W
100K
40µf 450V
0.5µf 600V
+850
+300
"X" 6.3 VAC
12
1
2BP1

Fig. 1. Schematic of K8ERV's RTTY scope using transistor deflection amplifiers.



Internal parts layout showing the location of the amplifier board, controls, power supply and CRT with shield. The CRT shields are available inexpensively from many 73 advertisers.



Board containing the vertical and horizontal amplifiers and the blanking circuit.

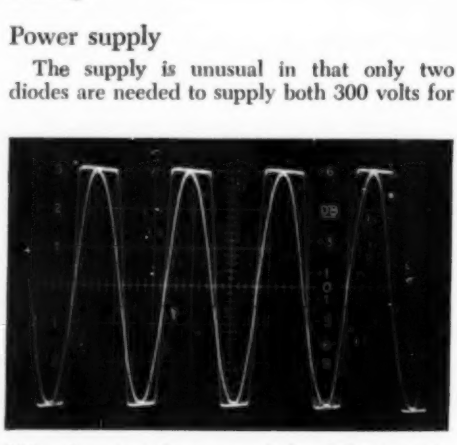
setting from 20 k to 100 k. Higher impedances may be obtained by adding series input resistance. The bandwidth is from 50 Hz to over 20 kHz. The lower response can be improved by increasing the values of the 0.1 μf input condensers. Heat radiating fins on the deflection transistors are desirable but not essential.

Blanker

A particular problem with RTTY scopes is that often an undeflected spot occurs, which burns the screen. With the blanker, the undeflected spot is adjusted for very low intensity with the "spot int." control. Any input signal drives Q_3 into conduction, shunting the intensity control with the second, "trace int." control. This is adjusted for proper operating brilliance. This circuit completely prevents screen burning.

Power supply

The supply is unusual in that only two diodes are needed to supply both 300 volts for the amplifiers and 850 volts in a multiplying circuit for the CRT. Any small 500 volt transformer will work. If the B+ is much over 300 volts, increase the 100 ohm surge resistor. If you need more voltage for a 3 or 5 inch tube, replace the 0.5 M resistor with another 1800 volt diode, and raise the voltage rating of the two 0.5 μf filters to 1000.



300 volt output from one of the deflection amplifiers.

Adjustments

Remove Q_3 from its socket then plug in the scope. Check the B+ for about 300 volts, using a Variac if necessary to keep it down. Connect a VTVM or 20,000 OPV meter on the 500 volt range to the collector of Q_1. Select or pad the base to ground resistor to obtain a voltage of ½ B+. Do the same with Q_2. Now adjust the power supply resistor for a 300 volt B+ with normal line voltages.

Now adjust the focus and spot intensity controls for a small dim spot. Unplug the scope, wait ten seconds, plug in Q_3, and plug in the scope. The spot should be the same as before. If it is brighter, either the transistor or its base coupling condenser is leaky, or the transistor has too low a breakdown voltage.

Obtain a full deflection by switching the input selector to "Cal." and adjust the "trace int." control for a bright sharp pattern. Removing the signal will cause the remaining spot to dim to the intensity set by the "spot int." control.

This scope was built as a separate unit with input selector so that it could be used to monitor several different TU's. It is small enough to be built into compact TU's or other equipment. If you aren't yet using transistors, this is an excellent first project, with practically nothing to go wrong?

. . . K8ERV

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- **Controlled-Carrier Screen Modulator** for AM built-in.
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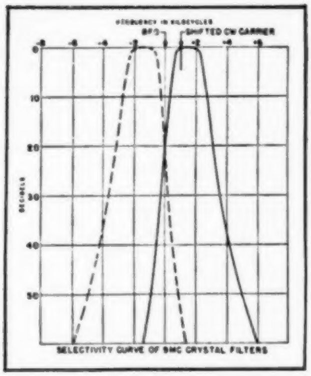
- **Two Special 9 Mc Crystal Filters** for sideband selection.
- **Separate RF and AF Gain Controls.**
- **1 Kc Dial Accuracy.**
- **100 Kc Crystal Calibrator** built-in.



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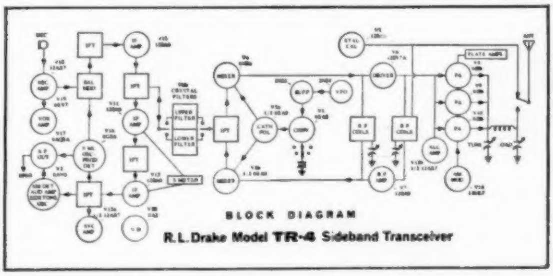

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50 Watts on 50 mc for $50

Build this low-cost, simple-to-construct rig for a potent signal on six meters.

Persistently pursuing our policy of building low-cost rigs for various bands from 1296 down to 50 mc this article describes our new 50 watt six meter station using only two low cost tubes in the RF section including a rock-stable VFO. It ought to be rock-stable: it has a 46 megacycle rock in it!

And no frequency multiplication to also multiply drift, FM, hum, etc. I happen to be in a round table with this rig while writing and interest is considerable in a modular type low-cost compact 50 watt rig which also includes VFO. Adverse comments are also being made about small rigs that are rock-bound. Six meters today is definitely a VFO band so this is considered a must for any new home-brew station.

The size is handy, the final being 2 inches high, by 6 wide and 5 deep, and the single tube crystal controlled VFO exciter about the same size. So, enough small talk, let's get into the main course.

It takes a little work to put 50 watts on 50 mc for $50 with a VFO rig. After all though, there are thousands of amateurs who can buy the $300 to $400 rigs, but there are also some tens of thousands who cannot! At least not yet in their careers. But anyone can afford this rock-stable 50 watt rig. Let's add it up: The exciter module comes to about $6 for the capacitors, socket, small parts, etc., if you don't have a junk box and get them all out of the catalog. Tube is $2 and crystal is $4—a total cost of $12 for a rock-stable VFO with one third watt output on 6 meters.

The rf final comes to even less. It looks like about $10 from here including the tube. I suppose someone will write in and say, "Bill, you forgot the hootenany for $1.25." After all, even if you are only 14 years old and don't yet have any junk box at all, you can take apart some old TV sets and start one.

The modulator sure boosts the cost though. It costs $22 for the parts and $6 for the tubes

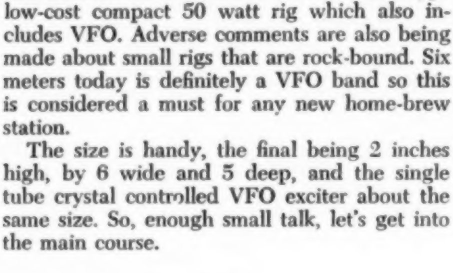

1/3 6AF11
XTAL OSC
1/3 6AF11
MIXER
47 MC
L2
C1
20pf
L1
47 MC
C2
1-5pf
C6
25pf
L5
50-51 MC
L6
7
6
5
2
11
10
9
33K
10K
.01
62K
100K
.0047
.0047
O+200
1/3 6AF11
LOW FREQ OSC.
L4
50pf
O6 VAC
12
1
.1µf
100pf
C3
100pf
L3
3-4MC
C5
100pf
C4
100pf
4
3
7
10K
.1µf
9K

Fig. 1. Six meter heterodyne VFO exciter using one Compactron. Output is about 300 mw.

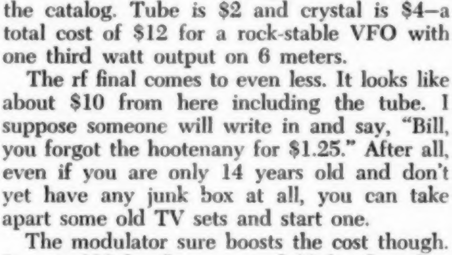

1-5pf
Cn
3,4,5
7984
C2
20pf
L3
• SEE FIG. 3
L4
J2
RF OUT
7,11
10
C4
C5
C1
20pf
2,6,8,9
J1
L1
L2
• Ln
1-5pf
250pf
EACH PIN
C6
500pf
C7
500pf
NO. 48 OR 49
C3
.001
20K
1W
20K
5W
12
1
J3
J4
J5
GRID METER
0-5 MA
MODULATOR
SECONDARY
PLATE METER
0-250 MA
+300-500V
12VAC

Fig. 2. 7984 Compactron final amplifier. This amplifier puts out over 50 watts with less than one-third watt drive. Note that the tube requires 12 volts on its filament.

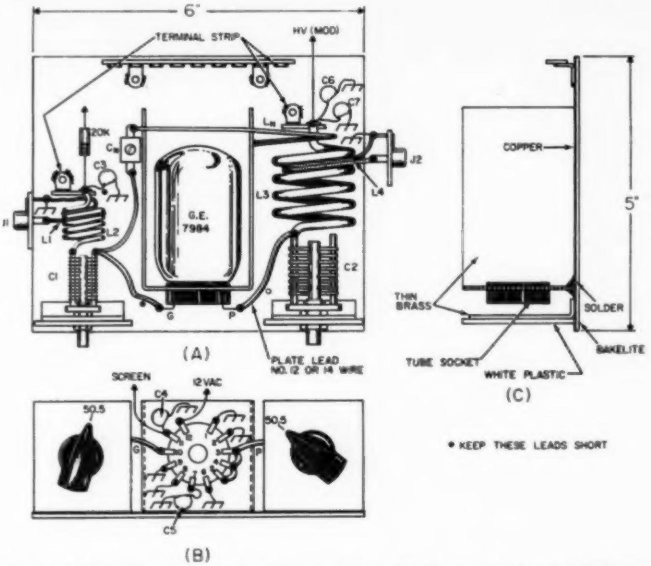


Fig. 3. Recommended layout for the 7984 final amplifier.

for a total of $28. Get busy on that junk box!

So that gives us the whole rig for $50 (less power supply). We made it. But only just, as the Scotsman said counting his change at the bank.

The exciter

The exciter (**Fig. 1**) was covered in the April 1965 issue of 73, but we reprint the circuit here for your convenience. Just to be sure, I built a second one directly from the article and it worked immediately and excellently.

It uses a 6AF11 Compactron tube, which has two excellent triodes for the oscillators and a high gain video pentode for the mixer, all in one little $2 bottle, definitely a bargain.

The principle of using a 46 mc crystal and then adding a 4 to 5 mc variable oscillator in a mixer is a sound one and has been around for many years. Some 90% of the frequency determination is done by the crystal oscillator. Also, any hum, FM, etc., in the 4 to 5 mc oscillator is not multiplied as in conventional VFO transmitters. The results are really worthwhile. I use ordinary 100 pf variable capacitors, copper-clad bakelite base and shielding, no voltage regulator and only one $2 tube. Also, only one crystal. For the whole exciter!

Make sure that you get the 50 mc output and not 46 mc or one of the other frequencies generated in the mixing process. Also don't overcouple the link coupled stages. This will keep down TVI.

The rf output on 50-51 mc is about 300 mw which is sufficient to drive another Compactron, the 7984, to 50 watts output! I got about 2 ma of grid drive.

The plate voltages on the three sections of the 6AF11 are: crystal oscillator, 75 volts; 4-5 mc oscillator, 180 volts, mixer, 275 volts.

The RF amplifier

The modular construction of the exciter and RF amplifier (**Fig. 2**) is quite convenient for building, tune up and final tests on the air. I find that laying the tube on its side as shown in **Fig. 3** with the 12 pin socket centered in a small vertical thin brass panel makes it easy to work on the socket and forms a module only 2 inches high by 6 inches wide by 5 inches deep. Keep the leads short—as is easy to do if you follow the layout—and ground all four cathode leads.

The neutralization system is an afterthought. I went into this subject in the August '65 issue of 73, so instead of having to rebuild the entire rig when self-oscillation showed up, I just added the outboard neutralizing as described. Don't forget that the 7984 is a red hot beam power tube. It takes only one third watt drive from the exciter to light a 50 watt bulb to full brilliancy. Figure that gain out!

To adjust the neutralization, remove the excitation and the output coupling and put enough plate voltage on for about 100 ma plate current. Then adjust C1 and C2 for self oscillation (unless you happen to be lucky in

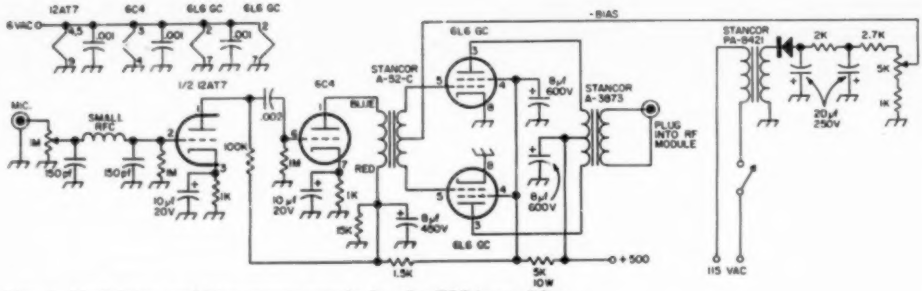

12AT7
6C4
6L6 GC
6L6 GC
6VAC
4,5
.001
3
.001
2
.001
2
9
4
7
7
-BIAS
6L6 GC
STANCOR PA-8421
2K
2.7K
5K
1K
20µf 250V
STANCOR A-52-C
1/2 12AT7
6C4
MIC.
SMALL RFC
1M
150pf
150pf
1M
10µf 20V
1K
100K
.002
1M
10µf 20V
1K
BLUE
RED
15K
8µf 450V
8µf 600V
STANCOR A-3873
PLUG INTO RF MODULE
8µf 600V
6L6 GC
1.5K
5K 10W
+500
115 VAC

Fig. 4. Modulator and bias power supply for the 7984 amplifier.

your setting of Cn). Some setting of Cn then will give no self-oscillation. Make sure that L1 and L4 are uncoupled from L2 and L3 while you're doing this.

You can also neutralize the final amplifier by many other methods, such as no grid current dip when the plate circuit is tuned through resonance, or by looking at the RF output fed through the plate-grid capacitance with a diode detector and no plate voltage. The methods I used worked so easily that I didn't try any others and there has been no self-oscillation since.

Modulator

This is a more or less standard 30 watt modulator using two 6L6GC's as push-pull modulators. Two 6L6GC's can put out 55 watts of audio, yet cost only $2 apiece: they're *the* modulator tubes as far as I'm concerned.

This modulator (**Fig. 4**) has only enough gain for use with a high output microphone such as the Astatic model 150 ($3.82) (−44 db output) that I use. This low gain helps prevent rf feedback into the transmitter and so far I've had no trouble with this normally common problem on VHF.

The modulation transformer I am using is a Stancor A-3873 rated at 25 watts maximum audio output, 8500 ohms plate to plate to a secondard load of 8000 ohms. Maximum DC is 100 ma per side. This is being stretched a little on the modulator side, but so far it's OK. Browsing through the catalogs I see a 30 watt multi-impedance UTC transformer for only $9.30, which should be a good bet.

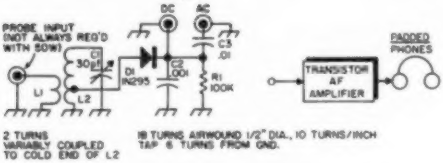

OUTPUT
DC
AC
PROBE INPUT (NOT ALWAYS REQ'D WITH 50W)
C1 30pf
D1 IN295
C2 .001
C3 .01
R1 100K
L1
L2
TRANSISTOR AF AMPLIFIER
PADDED PHONES
2 TURNS VARIABLY COUPLED TO COLD END OF L2
18 TURNS AIRWOUND 1/2" DIA., 10 TURNS/INCH TAP 6 TURNS FROM GND.

Fig. 5. RF detector for checking the six meter transmitter.

You can check the modulator with three 7 or 10 watt 110 volt bulbs in series across the modulator secondary and no rf load attached. They should light up quite brightly.

Station assembly

This is an important part of the station, and can really run up the cost if you're not careful. For transmit-receive switching, I use a two position, four pole ceramic switch fastened flat against a copper-clad bakelite panel with three coaxial cable braids soldered to it up real close to the switch contacts. Be sure to use a ceramic switch.

The other three poles open or close the receiver voice coil and switch the 275 and 500 volt power supplies. This is done on the AC side of the rectifiers. There is a slight drift on the crystal VFO as the filter capacitors charge up, but it always settles down immediately to the same spot.

I find it best to use one small power supply for the exciter and a larger 500 volt supply for the modulator and final. Actually, it would be better to use three supplies, with separate ones for the rf final and modulator. You can use any supply you have around from, say, 300 to 500 volts. Over 500 you're on your own.

For carrying the station around, I use a set of wood shelves with the exciter and rf at the top shelf, the modulator next, and the power supply on the bottom, with a piece of dowel across the top for a handle. As you may have read, I have an AC putt-putt and like mountain topping.

RF detector

As I final check I find it indispensible to listen to my own modulation. Also for hum or distortion on the carrier. This is by no means easy to do properly. In fact, for most of my amateur existence (first license 2BAV in 1923) I relied on reports from other amateurs on the air for modulation checks. The usual receiver does not do a good job at all, as you probably know by experience. What *does* do a good job is a handy-dandy assembly as shown in **Fig. 5**. This set-up with a long pointer knob for good resolution between 46 mc and 50 mc makes a very useful piece of test equipment. Do not use a regular tube type of amplifier. The padded earphones are also a must. It's very simple. With your ears shielded from your own voice as far as sound goes, a good bit of audio gain, you can hear exactly what you sound like, right in your own shack, using a dummy load if you wish. Note that you are listening to yourself on a receiver and you can hear any hum, distortion, feedback, etc., can be heard instantly. You cannot pick up frequency drift or FM on such a receiver, but you can check those on a regular communications receiver.

Four element beam

This rig has been used so far with the four element beam shown in **Fig. 6**. This is a little firecracker and really pushes the signal up about ten times in power (10 db) in one direction while taking it away from another one, of course. I just took the beam down and measured it with a steel tape to make sure the dimensions were exactly correct. If you make it exactly as shown, it will have the same power gain. It's shown as a rigid array, but you can adapt it to portable use with folding joints without too much trouble.

Up to now, I've been using 15 feet of TV masting out on the roof with an armstrong rotator handle just outside the window. It works fine and I'm having no end of fun with it.

So I'm on six meters again, and have chatted with dozens of old friends, and, I hope, made some new ones. I haven't moved out of the shack while building this rig, which means that my junk pile may be a little more extensive than some, after all, it does cover 45 feet long of cellar space, but I *did* look into the catalogues and add up the amateur net prices of the components for you.

It actually is possible to get on the air with *VFO* (this is very important. Ordinary VFO asemblies can be expensive) and 50 watts out for $50.

. . . K1CLL

Exciter Coils

L1. 7 turns airwound, 16 turns per inch ⅝ in. diameter. B & W 3003, Air Dux 416T.
L2. 6 turns of plastic covered No. 22, ¼ in. O.D., ⅜ in. long. Inside L1.
L3. 2 in. of ½ in. dia. 32 turns per in. B & W 3004, Air Dux 432T.
L4. 15 turns of No. 28 dcc wound on cold end of L5.
L5. 13 turns airwound 8 tpi.
L6. 2 turn adjustable link over cold end of L5.

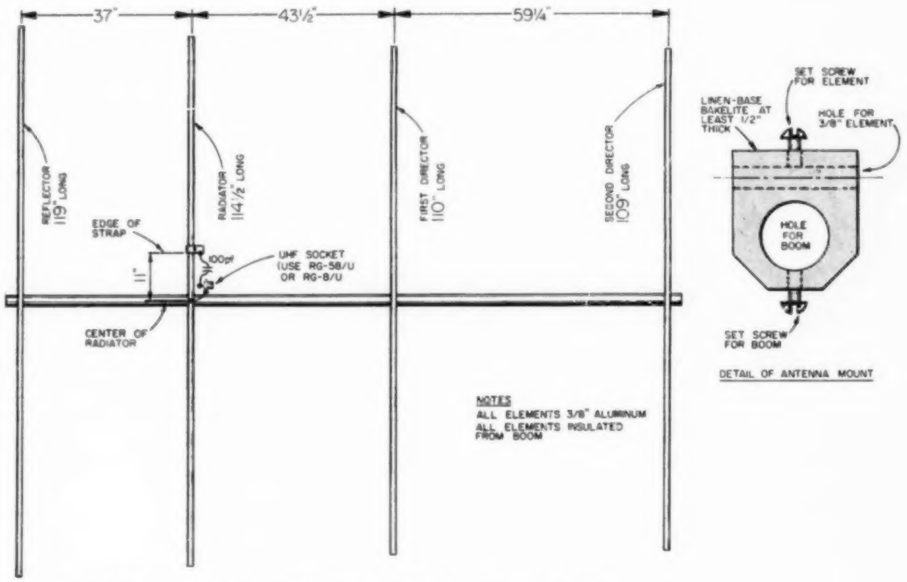

37"
43½"
59¼"
REFLECTOR 119" LONG
RADIATOR 114½" LONG
FIRST DIRECTOR 110" LONG
SECOND DIRECTOR 109" LONG
EDGE OF STRAP
11"
100pf
UHF SOCKET (USE RG-58/U OR RG-8/U
CENTER OF RADIATOR
NOTES
ALL ELEMENTS 3/8" ALUMINUM
ALL ELEMENTS INSULATED FROM BOOM
SET SCREW FOR ELEMENT
LINEN-BASE BAKELITE AT LEAST 1/2" THICK
HOLE FOR 3/8" ELEMENT
HOLE FOR BOOM
SET SCREW FOR BOOM
DETAIL OF ANTENNA MOUNT

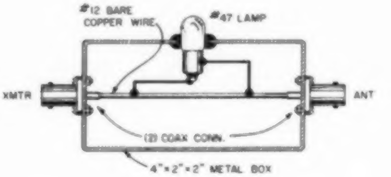
Fig. 6. Four element six meter beam. Good for about 10 db gain.

John Weatherly K1ZYG

The Dummy Loader

Did you ever wonder whether your RF was actually getting to your antenna or merely heating up the shack? The Dummy Loader is a gadget which indicates to dummys like me that the RF is in fact where it should be. Remembering that commercial transmitters use a sampling current for this purpose I figured I better have one, but RF Ammeters are expensive and there is an easy way to do essentially the same thing.

Take a small metal box about 4"x2"x2" and remove its cover. In each end of the box install a coaxial connector of the type suitable for the transmission line being used. Between the center contacts of the connectors solder a length of bare #12 copper wire. Now find a 6.3 pilot lamp (#47) and solder a pair of 2" leads to it. One of these two leads is now soldered to the center contact of either of the connectors. Next connect the gadget into the transmission line on the output side of the antenna change over relay and connect the feed line to the other end of the gadget. Make certain at this point that the coaxial connectors are making good electrical contact with the box.

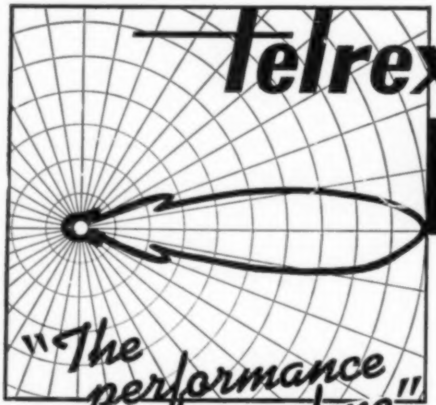


The Dummy Loader. Use coax connectors to match your system.

Apply power to the rig in the normal manner. At resonance lightly touch the free lead from the bulb to the #12 wire at a point about one inch from the soldered connection of the bulb. At this point observe that the lamp barely glows. (If not, turn out the lights in the shack or slide the loose contact along the #12 wire until a small glow is seen.) Retune the rig for maximum bulb brilliance. CAUTION: If you get too much brilliance the lamp will not last and power will be lost. When you have found the right spot TURN OFF THE TRANSMITTER and solder the connection to the copper wire.

At the center point of the cover plate drill a ¾" hole and fit it with a grommet which will allow the grommet to hold the lamp securely. Slide the lamp into the grommet and secure the cover to the box and the job is complete. The device can be and is intended to be left in the line at all times since the power required to light the lamp is negligible as compared to the 50-100 watt input to the transmitter for which it was designed. If lower power operation is used change the bulb to a 1.5 volt type and readjust the sliding contact. So get busy and watch your contacts increase.

. . . K1ZFG



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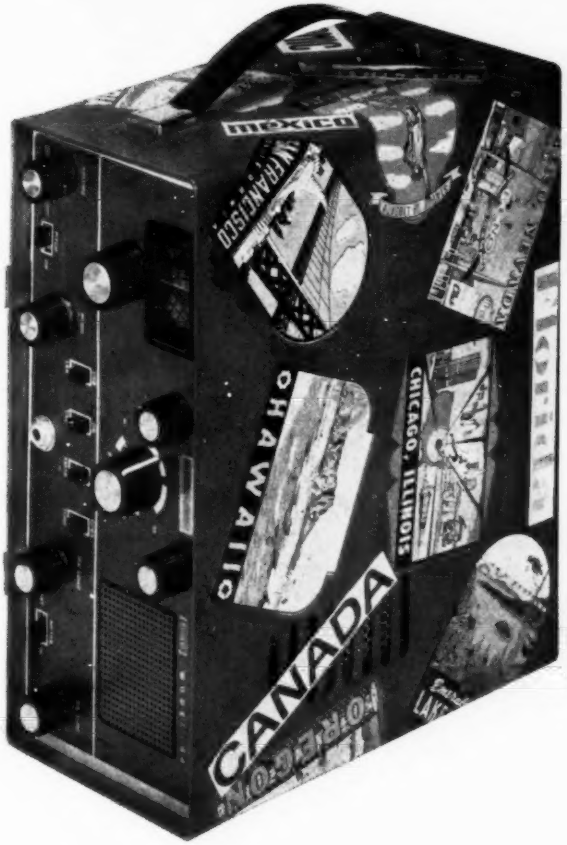

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144 mc Transistor Converter

Build this simple, low-cost transistor converter and filter for a 2.5 db noise figure and lots of DX.

The units shown in **Fig. 1** and **2** and in the photographs are part of the system described in a previoust article. The problems encountered in transistor converters were discussed in detail and a 50 mc converter with its associated antenna filter were included. This section concerns the design of a converter and antenna filter for 144 mc band operation.

Two meter antenna filter

The antenna filter is built in a massive type of construction in order to obtain very high Q circuits so that the loaded Q will be only a small fraction of the unloaded Q values. If the unloaded Q is perhaps 1000 and the loaded Q is 25, the circuit loss will only be 2.5% per circuit or 5% for two circuits. This would mean about .5db loss in noise figure which is low enough for good dx reception in a quiet location with a good antenna. The transistor converter shown here has a noise figure of a little under 2db which with the antenna filter adds up to 2.5 db. If the coax antenna feeder has a loss of from .5 to 1 db, the net NF amounts to 3 to 3.5 db which is far below the more usual 5 to 10 db NF of the average VHF station. Even a good parametric amplifier and antenna feeder system is seldom more than one db better than the transistor converter shown in **Fig. 2**. 144 paramps are very narrow band units and only function into and out of resistive loads. Any regeneration in the converter rf stage, or change of SWR in the antenna system with rotation of the beam or due to weather changes can make a paramp into a real monster for oscillation instead of amplification. Good ferrite "isolators" to tame a 144 mc paramp cost nearly as much as a radio receiver.

Frank is one of the outstanding VHF authors and this is his second appearance in 73. Last month he described a six meter filter and converter similar to the one described in this article.

Fortunately, new economical transistors are being made available which are better than vacuum tubes for rf amplification at 144 to 148 mc. Each year brings forth some new transistors which are better, and at the moment there is one priced near 50 cents, the TIXMO5, which makes even a good paramp system unattractive for dx reception. In time transistors may reach down near the one db NF which can be used for moon bounce or satellite amateur signals.

These high angle received signals are less troubled by man-made noise if the antenna system has very low side and back lobes of response. Even on reception along the horizon of 144 mc signals it is better to hear external man-made noise than front end receiver noise. Some operators feel that there is no advantage in getting the receiver NF below the man-made or atmospheric noise level. However, this writer doesn't agree since the human ear is a good differentiator of signal to variable noise level, being able in some cases to reach well below the 0 db signal to noise ratio. Man-made power buzzes, auto ignition and appliance electrical noises and atmospheric static crashes are not too much like the hiss of receiver noise, which means that good *if* noise blanker systems and noise limiters in the radio receiver can be of real service in reception or radio signals. All this means that the VHF amateur should strive for a good low NF in his receiver system.

The converter shown here has a low NF, measuring from 1.7 to 2 db over the range of 144 to 147 mc. Since present day low priced transistors overload easily, out-of-amateur-band strong commercial stations can produce the effect of spurious signals within the amateur bands. This effect is more noticeable in a low NF converter. A good antenna filter ahead of the converter tends to eliminate this problem as long as the signals are not within the pass-band of the filter. The filter shown in **Fig. 1** consists of two tuned circuits, slightly overcoupled, so as to produce a pass band of from 2 to 3 mc with close to 50 ohms input and output terminations. The circuits were made large physically in order to have very low losses and a secondary benefit was obtained. The filter is very effective in preventing spurious signals in the transmitter from getting into the antenna. Both lower frequencies from the exciter stages and harmonics of 144 mc are greatly attenuated in this filter which helps meet FCC requirements. The losses are low enough and the voltage ratings high enough so full legal power may be run in the radio transmitter.

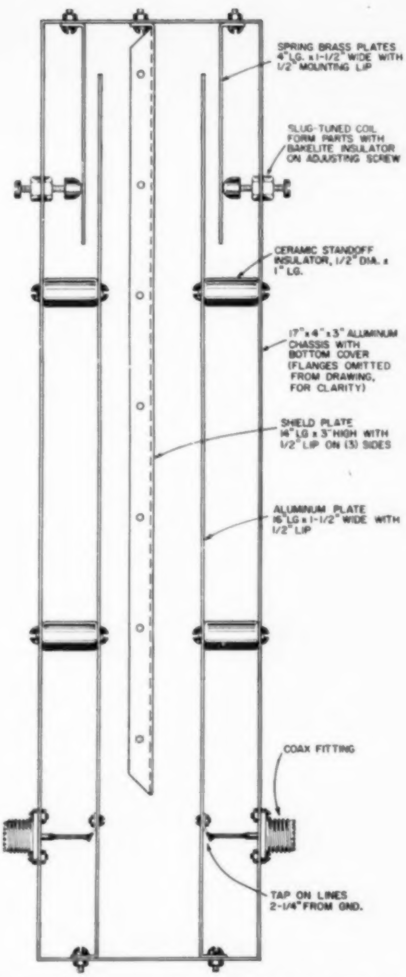
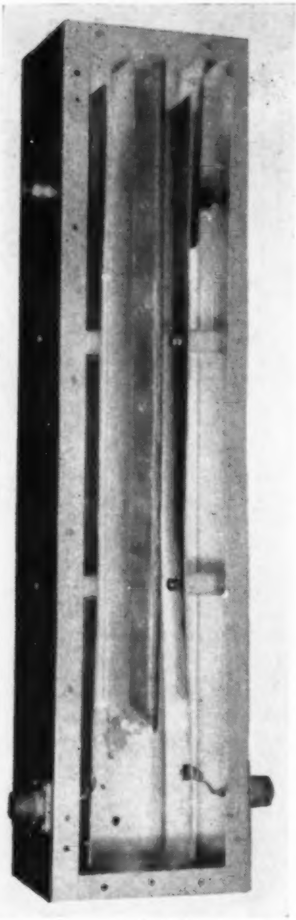

SPRING BRASS PLATES 4" LG. x 1-1/2" WIDE WITH 1/2" MOUNTING LIP
SLUG-TUNED COIL FORM PARTS WITH BAKELITE INSULATOR ON ADJUSTING SCREW
CERAMIC STANDOFF INSULATOR, 1/2" DIA. x 1" LG.
17" x 4" x 3" ALUMINUM CHASSIS WITH BOTTOM COVER (FLANGES OMITTED FROM DRAWING, FOR CLARITY)
SHIELD PLATE 14" LG x 3" HIGH WITH 1/2" LIP ON (3) SIDES
ALUMINUM PLATE 16" LG x 1-1/2" WIDE WITH 1/2" LIP
COAX FITTING
TAP ON LINES 2-1/4" FROM GND.

Fig. 1. Two meter antenna coupler-filter. This drawing is one-third size.

The filter shown in **Fig. 1** was built into a 4 x 3 x 17 inch aluminum chassis and cover. A center shield with top and bottom grounding lips separates the two tuned circuits and the 3 by 3 inch cut out at the low rf potential end acts as the aperature coupling between circuits. This was started as a 2 inch cut out and the coupler used from 143.95 to 145 mc originally, then trimmed out in steps to 3 inches long for bandspreading the filter to cover from 2 to 3 mc width. Each tuned circuit consists of an aluminum plate line 16 inches long and 1.5 inches wide supported by an additional .5 inch right-angle lip for grounding and by two ceramic insulators as indicated in the sketch of **Fig. 1.** The tuning capacitors at the "hot" ends consists of pieces of spring brass 4.5 x 1.5 inches in size with .5 inch grounding lips. All grounding lips and mounting areas were sanded to get bright clean contacts and each grounding lip was fastened to the chassis with three machine screws. These grounding areas must have very low resistance in order to keep the circuit losses down to a minimum. Copper lines and shield box would provide less loss than aluminum, especially if the filter had to be made more compact in size. The spring brass tuning condenser plates are adjusted by means of spare slug coil form mountings with a .5 by .5 inch bakelite insu-



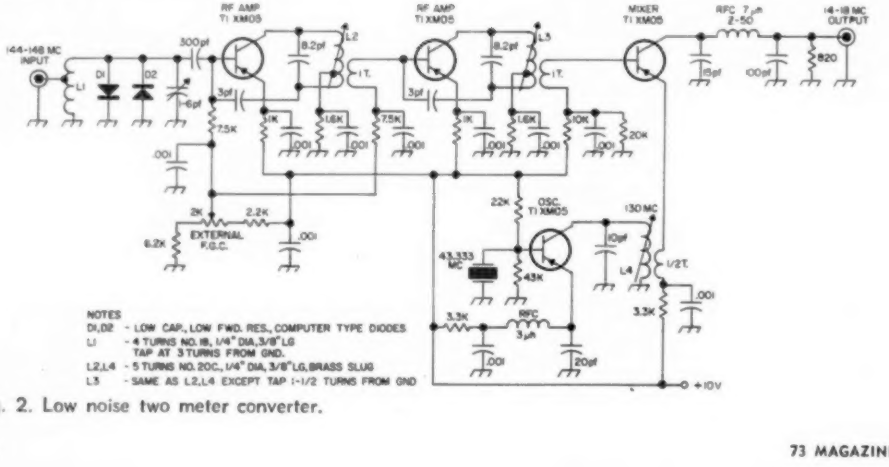
Two meter antenna coupler-filter.

lator threaded onto the adjusting screw and epoxy glued to it also. These adjusting screws were mounted about 3 inches from the ends of the 17 inch chassis centered on each 3 inch side. At the opposite end, coax fittings were mounted and tapped into the rf lines 2.25 inches from the grounded ends. Lots of self tapping screws were used to ground the center shield to the chassis and to the bottom cover, and the cover to the chassis. This cover was 5 by 17 inches in order to use the extending sides for mounting the filter up on the wall above the antenna relay.

Two meter converter

The converter was built on a piece of copper clad board 2 by 6 inches in size for mounting into a 6 x 17 x 3 inch chassis along with numerous other converters and a switching panel for *if* outputs and battery connections. The chassis completes the rf shielding of each converter which is needed to prevent direct pick-up of signals in the 13.95 to 19 mc *if* range. Double shielded small coax lines to the *if* receiver also are advisable. The double copper braid on some types of coaxial line is worth while unless these shielded converters are mounted within the shielded cabinet housing the *if* receiver.

The Texas Instruments TIXMO5 transistors are marvelous rf amplifiers, mixers and oscillator-multipliers. The only problem encountered was breakage since these units had plastic housings which were brittle, and broke easily when the transistors were pushed into the large transistor sockets shown in the photographs. Later some smaller sockets were purchased which overcame this problem since they were designed for TO-18 sized transis-


144-148 MC
INPUT
L1
D1
D2
1-6pf
300pf
3pf
7.5K
.001
RF AMP
TI XM05
8.2pf
L2
1T.
1K
.001
1.6K
.001
7.5K
.001
2K
2.2K
EXTERNAL
F.G.C.
6.2K
.001
RF AMP
TI XM05
8.2pf
L3
1T.
3pf
1K
.001
1.6K
.001
10K
.001
20K
MIXER
TI XM05
RFC 7 μh
2-50
15pf
100pf
820
14-18 MC
OUTPUT
22K
OSC.
TI XM05
130 MC
43.333
MC
43K
10pf
L4
1/2T.
.001
3.3K
3.3K
RFC
3μh
.001
20pf
+10V

NOTES
D1,D2 - LOW CAP., LOW FWD. RES., COMPUTER TYPE DIODES
L1 - 4 TURNS NO. 18, 1/4" DIA, 3/8" LG
TAP AT 3 TURNS FROM GND.
L2,L4 - 5 TURNS NO. 20C., 1/4" DIA, 3/8" LG, BRASS SLUG
L3 - SAME AS L2,L4 EXCEPT TAP 1-1/2 TURNS FROM GND

Fig. 2. Low noise two meter converter.

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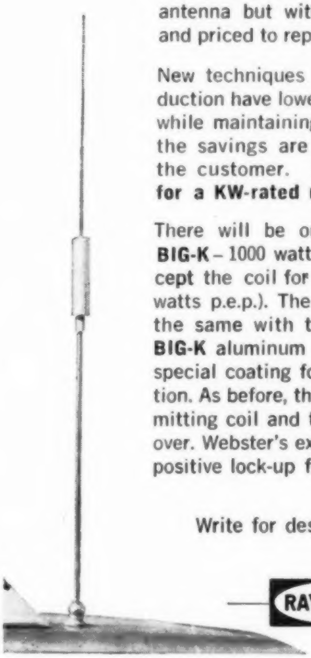
There will be only one type of coil—**BIG-K** – 1000 watts p.e.p. for all bands (except the coil for 160-meters which is 300 watts p.e.p.). The basic antenna remains the same with the exception that the **BIG-K** aluminum column will be given a special coating for environmental protection. As before, the column is hinged, permitting coil and top whip section to fold over. Webster's exclusive fast release and positive lock-up feature remains intact.

Write for descriptive literature.

PRICE INFORMATION

WMW-B	Fold-over mast and adjustable whip for KW coils. 93" long (Bumper)	**13.50**
WMW-D	Fold-over mast and adjustable whip for KW coils. 77" (Deck mount)	**13.50**
KW-80	1 kilowatt, 75 meter coil	**8.95**
KW-40	1 kilowatt, 40 meter coil	**8.95**
KW-20	1 kilowatt, 20 meter coil	**6.95**
KW-15	1 kilowatt, 15 meter coil	**6.25**
KW-10	1 kilowatt, 10 meter coil	**4.45**
TW-160	300 watt, 160 meter coil	**5.80**



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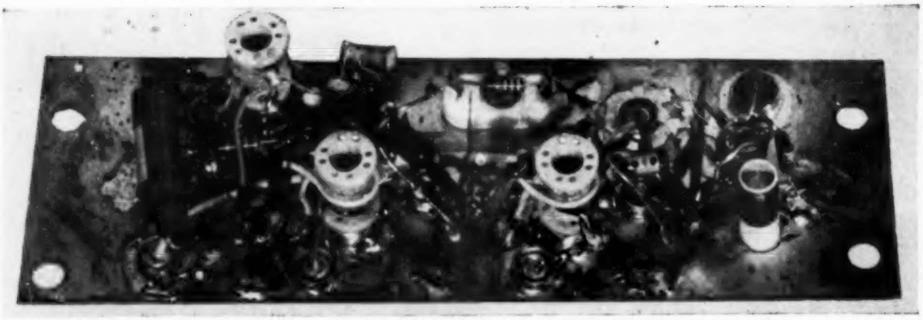


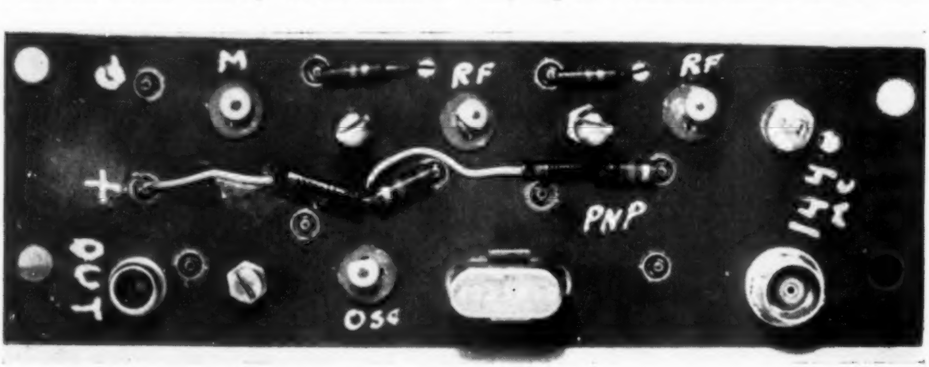
Bottom view of the two meter converter described in this article.

tors, but had the disadvantage of costing a great deal more than the TO-5 sized sockets. **Fig. 2** shows the circuit and values of parts used in the converter. White color coded ferrite slug coil forms of similar size may be used for slightly better Q values with 4 turn coils (and 1 turn taps) in place of the brass slug forms shown.

Two rf amplifiers with fixed neutralization were used with only one tuned circuit between stages since the antenna filter added a great deal of image suppression. The input circuit is a low Q (loaded) design in order to provide a low loss resistive termination to the antenna filter. This resulted in a NF of less than 2 db when a noise generator was connected directly into the coax input jack of the converter. The transistor protective back to back diodes across this input coil added about .1 db NF loss but was deemed worthwhile for protection against an antenna relay isolation deficiency when using a high powered transmitter. Low forward resistance diodes with low shunt capacitance are needed for this purpose. Type 1N100 diodes were used here, but better diodes are available. Don't use the old "standby" IN34A diodes in such a low impedance circuit such as shown in **Fig. 2.**

The mixer stage uses base input and emitter oscillator coupling with large enough bypass condenser values to give a low impedance even at the *if* frequencies. This avoids the need of series tuned (at 14 to 18 mc) circuits shunted from base and emitter to ground. The mixer collector circuit has to be of low Q design in order to cover 4 mc bandwidth. The pi network of **Fig. 2** meets this requirement and fixed values of capacitors and inductance may be used to obtain a center frequency of about 16 mc to cover from 14 to 18 mc. The values shown provide a mixer load impedance of about 2000 ohms or more, with an output impedance of 50 or 75 ohms for connection to the *if* receiver.

The 43.3333 mc overtone crystal oscillator has an emitter circuit resonant about midway between the overtone and fundamental crystal frequencies. This insures oscillation at the overtone frequency only and permits the single transistor to provide 130 mc output in the collector circuit for coupling into the mixer stage. Transistors other than TIXMO5 may require a different value of emitter con-



Top view of the two meter converter

denser than the 20 pf shown since this value regulates the regeneration at the 130 mc output frequency. Less efficient transistors require smaller values. The small 3 μh rfc in this emitter lead must resonate with the small emitter bypass (20 pf or so) at some frequency above 15 mc but below 43 mc. Resonance below 15 mc will cause the overtone crystal to oscillate at its fundamental and introduce a strong signal into the *if* receiver tuning range. If this effect is present use a smaller inductance such as an Ohmite Z144 rfc of 1.8 μh. Too small a value of capacitance from emitter to ground may cause oscillation near 130 mc not crystal controlled. Too large a value will cause less output at 130 mc than is needed for good mixer conversion gain. Too much oscillator voltage injection into the mixer is undesirable so a value of coupling link should be chosen to provide a little less than maximum mixer gain and noise. All of these adjustments interact to some extent so some experimenting is desirable if optimum results are to be obtained.

In locations where there are other two meter ham stations, an rf gain control is needed, which is external to the converter. This is a type known as forward gain control since the current in the transistor is increased to reduce the gain. This requires a collector resistor and rf bypass condenser which reduces the collector dc voltage fast enough to cause a gain reduction as the current increases. Forward gain control is many times better for overload and cross-modulation reduction as the transistor gain is reduced as compared to the more usual current reduction-gain reduction circuits used in many transistor rf and *if* designs. By the same token, forward automatic gain control (FAGC) in transistor *if* systems is highly desirable. With PNP type transistors FGC of the type shown in **Fig. 2** causes a collector current increase and gain reduction as the potentiometer is moved to a less positive voltage setting. The values of limiting (fixed resistors) and potentiometer values can be chosen to give optimum gain control for nearly any type of transistors. The total resistance across the battery supply can be of values such that the battery drain is somewhere between ¼ and 1 ma in the main control unit. The transistor base current (microampere values) is then negligible in figuring resistor values. These values should be such that the transistor collector current in each rf stage varies from about 1 ma at full gain (or lowest NF) to about 3 ma at reduced gain and 1 volt or so across the collector to emitter.

. . . W6AJF

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Low noise, inexpensive, easy-to-build converters and filter for our highest VHF band

220 mc Transistor Converter

The 220 to 225 mc band in many locations is subject to strong image signal problems which can be reduced greatly by using a pair of high Q circuits in the antenna feeder. An antenna filter of this type suitable for transmitting and receiving service is shown in **Fig. 1.** It consists of two high Q circuits capacity coupled together at the tuning end of each line and loaded down to a working Q of about 25 for 50 ohm coaxial input and output lines. This loading is chosen by the position of the coax jack taps on each flat plate line near its grounded end. A tap point 1.5 inches from ground end seemed to function well over a large portion of the 220 mc band. The circuits are tuned to resonance by spring brass plates with adjustable spacing to the flat plate line at the "hot" end. The coupling capacitor is at this end also and consists of an insulated U shaped metal bracket as shown in **Fig. 1.**

The coupling depends upon the spacing at the ends so some adjustment can be made by bending the sides of the U bracket or by making a new one with more or less length between the sides of the U. Probably a better coupling scheme would be an aperture cou-

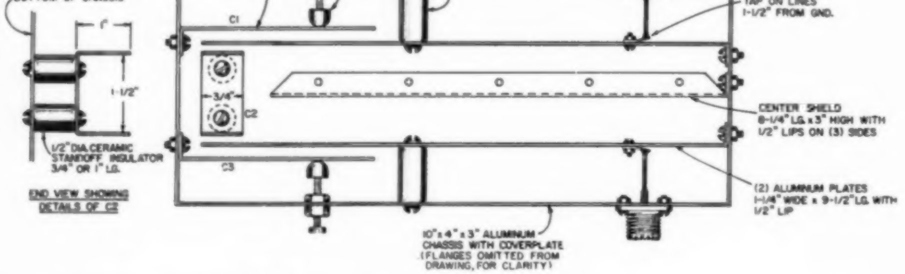
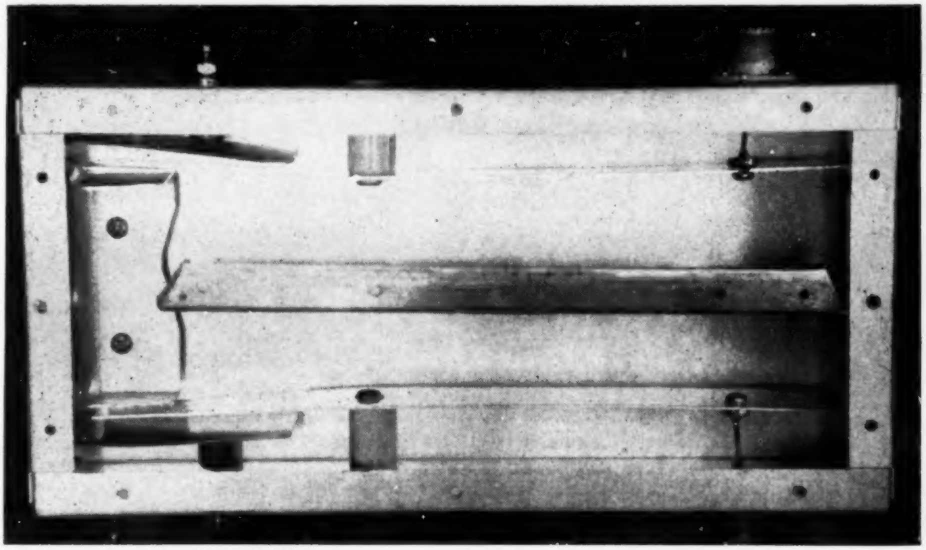
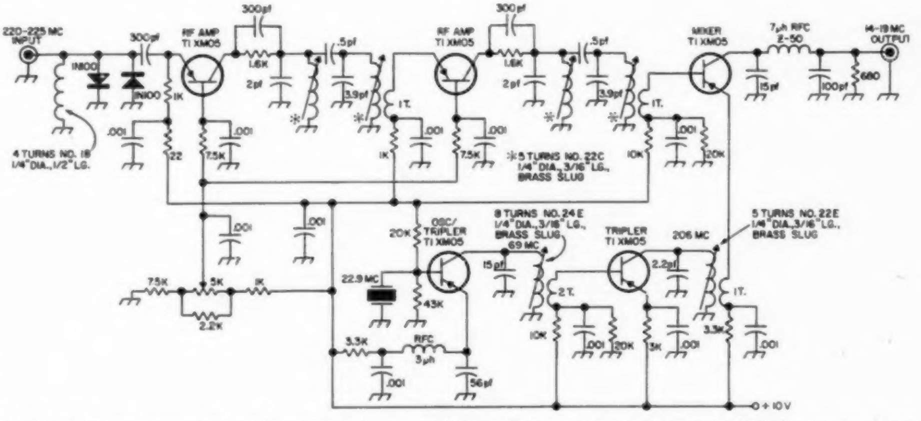

C1 & C3 ARE SPRING BRASS PLATES 3-1/2" x 1-1/2", WITH 1/2" LIP FOR MOUNTING
ADJUSTING SCREW
BAKELITE
1/2" DIA. x 1" LG. CERAMIC STANDOFF INSULATOR
COAX FITTING
BOTTOM OF CHASSIS
1"
1-1/2"
C1
3/4"
C2
C3
TAP ON LINES 1-1/2" FROM GND.
CENTER SHIELD 8-1/4" LG. x 3" HIGH WITH 1/2" LIPS ON (3) SIDES
1/2" DIA. CERAMIC STANDOFF INSULATOR 3/4" OR 1" LG.
END VIEW SHOWING DETAILS OF C2
(2) ALUMINUM PLATES 1-1/4" WIDE x 9-1/2" LG. WITH 1/2" LIP
10" x 4" x 3" ALUMINUM CHASSIS WITH COVERPLATE (FLANGES OMITTED FROM DRAWING, FOR CLARITY)

Fig. 1. 220 mc antenna coupler-filter. This drawing is one-third size.



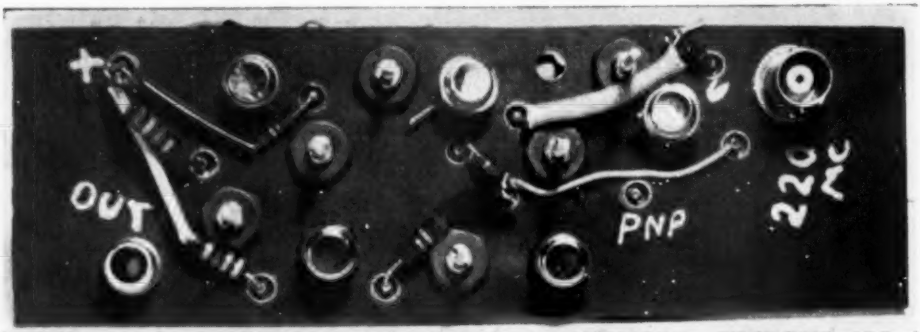
220 mc antenna coupler and filter.

pling at the high current end of the lines as was used in the 144 mc circuit unit previously described. The center shield with both sides grounded would then be about 8 inches long, also grounded at the tuning condenser end. The aperture would be a 2 inch gap (approximately) at the coax jack end, making a total aperture opening of 2 by 3 inches in size for coupling the two lines together. This would eliminate the coupling capacitor U shaped bracket at the opposite end of the lines. An aluminum chassis, with cover, 10 x 4 x 3 inches in size encloses the flat plate lines. This with the center shield forms two air gap strip lines of high Q design, perhaps in the neighborhood of Q = 1000 unloaded. With loading and coupling, the Q is around 25 which would mean a loss of about .5 db for the complete filter. This loss would mean about half a decibel loss in NF for receiving and at the same time an efficiency in this filter of over 90% for either transmitting or receiving. The air gaps and design should make it suitable for KW operation though the heat loss might make it advisable to use copper plate lines and shields for lower losses. When the heating ef-



220-225 MC INPUT
4 TURNS NO. 18 1/4" DIA., 1/2" LG.
1N100
1N100
300pf
RF AMP TI XM05
1K
.001
22
7.5K
.001
300pf
1.6K
2pf
.5pf
3.9pf
*
*
1T.
1K
.001
RF AMP TI XM05
300pf
1.6K
2pf
.5pf
3.9pf
7.5K
.001
*5 TURNS NO. 22C 1/4" DIA., 3/16" LG., BRASS SLUG
1T.
10K
.001
20K
MIXER TI XM05
7μh RFC 2-50
15pf
100pf
680
14-19 MC OUTPUT
.001
.001
7.5K
5K
1K
2.2K
20K
OSC/ TRIPLER TI XM05
22.9 MC
43K
3.3K
RFC 3μh
.001
56pf
8 TURNS NO. 24 E 1/4" DIA., 3/16" LG., BRASS SLUG
69 MC
15pf
2T.
10K
.001
20K
TRIPLER TI XM05
2.2pf
206 MC
3K
.001
5 TURNS NO. 22E 1/4" DIA., 3/16" LG., BRASS SLUG
1T.
3.3K
.001
+10V

Fig. 2. 220 mc converter with common base amplifiers. This circuit is recommended for general use because of ease of adjustment and simpler construction.



Top view of the converter in Fig. 2. The large transistors were replaced by TIXMO5's for better noise figure after this picture was taken.

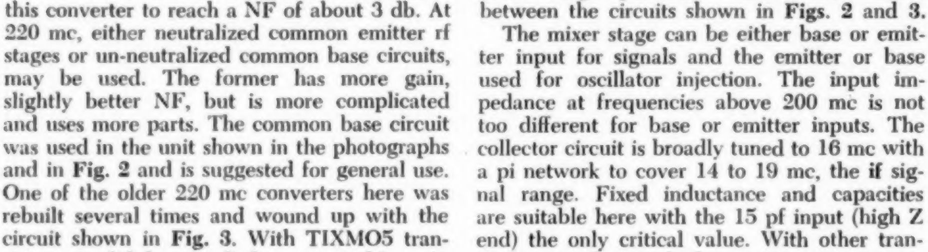
fects become readily apparent at very high power operation, the coupling and tuning capacities will change. Aperture coupling with copper or silver plated brass construction would then be indicated. The aluminum construction is suitable for antenna inputs of up to 200 watts with negligible heating effects.

220 mc converter

The new TIXMO5 transistors were used in this converter to reach a NF of about 3 db. At 220 mc, either neutralized common emitter rf stages or un-neutralized common base circuits, may be used. The former has more gain, slightly better NF, but is more complicated and uses more parts. The common base circuit was used in the unit shown in the photographs and in **Fig. 2** and is suggested for general use. One of the older 220 mc converters here was rebuilt several times and wound up with the circuit shown in **Fig. 3**. With TIXMO5 transistors, it did have a little more stable gain and a fractional db better noise figure but the "rats nest" wasn't suitable for photographing.

The circuit of **Fig. 2** consists of two grounded base rf stages, with forward gain control separate from the converter, 2 by 6 inch copper copper clad board. This control can be set for best NF, which is below the oscillation point in the rf amplifiers. This type of rf amplifier is regenerative and there is no easy way to neutralize the stages; however, a variable gain control with screw driver adjustment solved the problem. 220 mc is apparently near the upper frequency of common emitter, neutralized rf stage operation so there is little choice between the circuits shown in **Figs. 2** and **3**.

The mixer stage can be either base or emitter input for signals and the emitter or base used for oscillator injection. The input impedance at frequencies above 200 mc is not too different for base or emitter inputs. The collector circuit is broadly tuned to 16 mc with a pi network to cover 14 to 19 mc, the if signal range. Fixed inductance and capacities are suitable here with the 15 pf input (high Z end) the only critical value. With other transistor types having higher output capacitance, a smaller value than 15 pf would be needed and an adjustable 5 to 18 pf condenser should be used.



Bottom view of the converter shown in Fig. 2. The drum shaped object in the lower left is the crystal.

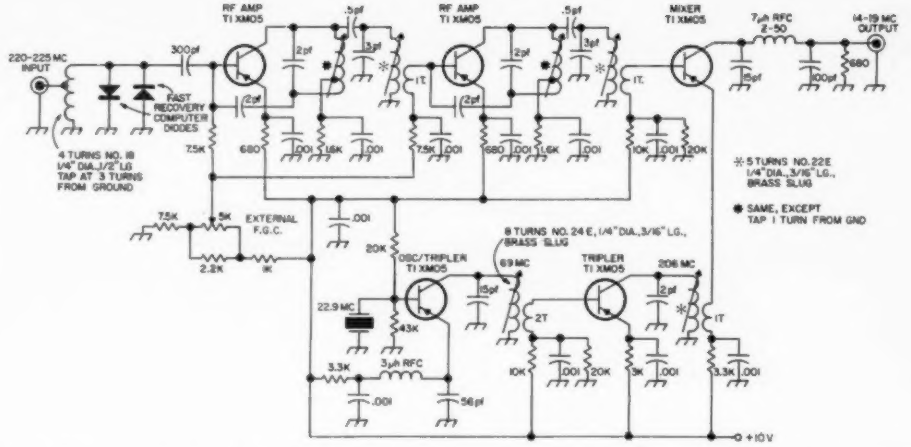

220-225 MC INPUT
4 TURNS NO. 18 1/4" DIA.,1/2" LG TAP AT 3 TURNS FROM GROUND
FAST RECOVERY COMPUTER DIODES
300pf
RF AMP TI XM05
2pf
.5pf
3pf
7.5K
680
.001
1.6K
7.5K
5K
EXTERNAL F.G.C.
2.2K
1K
1T
RF AMP TI XM05
MIXER TI XM05
7μh RFC 2-50
14-19 MC OUTPUT
15pf
100pf
680
10K
20K
✳ 5 TURNS NO. 22E 1/4" DIA., 3/16" LG., BRASS SLUG
✱ SAME, EXCEPT TAP 1 TURN FROM GND
8 TURNS NO. 24 E, 1/4" DIA., 3/16" LG., BRASS SLUG
20K
OSC/TRIPLER TI XM05
69 MC
22.9 MC
43K
3.3K
3μh RFC
56pf
2T
TRIPLER TI XM05
206 MC
3K
3.3K
+10V

Fig. 3. 220 mc converter with neutralized common emitter amplifier stages. This converter gives a better noise figure and higher gain than the converter in Fig. 2, but is harder to adjust.

The oscillator multiplier chain has two transistors, one as an oscillator-tripler and the other as a tripler to obtain 206 mc output from a 22.889 (or 22.9) mc overtone crystal. The emitter circuit is resonant between 22.9 mc the third overtone, and 7.6 mc the fundamental frequency of the crystal. This prevents 7.6 mc oscillation and causes 22.9 mc oscillation at the third overtone frequency. In turn this is multiplied by three times to approximately 69 mc in the collector circuit. The 56 pf condenser in the emitter produces regeneration at the output frequency, resulting in good output to drive the second transistor tripler stage to 206 mc. This 206 mc power is coupled into the mixer emitter for mixing the 220 to 225 mc signals down to 14 to 19 mc, the output signal from the converter. The pi network transforms the high impedance of the mixer collector down to 50 or 75 ohms coaxial line output for connection to a receiver tuning the 14 to 19 mc range.

The input transistor is protected from overload by two diodes across the self resonant coil input circuit. These diodes were IN100 diodes which are not as good as fast computer diodes for this purpose but do a fair job since they are low forward resistance types suitable for VHF work. If better diodes of low shunt capacitance (at zero bias) are available, use them since transistors have much longer, low NF, life when not overloaded by transmitter signals leaking thru the coaxial antenna relay. As the operating frequency is increased, antenna relays are less effective in isolating the receiver from the transmitter. Very fast silicon type computer diodes generally have low enough capacitance to work as protective devices up to above 432 mc. A few germanium diodes rated for VHF with at least a 20 ma at +1 volt rating are fairly good at 220 mc.

A signal generator and noise generator are both desirable for use in aligning the converter for best weak signal reception and best NF. Oscillator operation can be roughly checked by listening to the hiss level in the if receiver when shorting out the oscillator or tripler tuned collector coils. The mixer noise in the receiver should be louder when the crystal oscillator is functioning. Too great an increase of noise may indicate excessive oscillator injection into the mixer or "blocking" type of oscillation in the crystal stage. The input coil turn spacing or even the number of turns may need adjustment for best NF and weak signal reception. Some protective diodes have greater or less zero bias shunt capacitance, which would mean that the input coil must be adjusted so it resonates at or near the low end of the 220 mc band. The transistor loading makes it very hard to "grid dip" adjust this circuit, so a noise generator is of great help at this point. The interstage slug tuned coils and the "gimmick" coupling condensers (a twist or two of plastic covered 24 or 26 wire) can be adjusted for maximum gain and best coverage of 220 to 225 mc. In case the converter is to be used mainly at some spot frequency such as 222 mc, the coupling condensers between tuned circuits can be of very small capacitance and all tuned circuits peaked up at that spot in the band. . . . W6AJF

Frank Jones W6AJF-AF6AJF
850 Donner Avenue
Sonoma, California

You'd be hard put to find a simpler, cheaper way to receive 432 mc than this excellent low noise converter.

432 mc Transistor Converter

The new Texas Instrument TIXMO5 transistors were rated for operation at 200 mc but are surprisingly good at 432 mc. These units compare very favorably with transistors costing many times as much, and at about 50 cents apiece, a few extra can be bought in order to get some very choice ones for the front end of a 432 mc converter. The writer found that about one out of every three were red hot for 432 mc operation and the other two out of three were still better than other $3.00 types generally used at 432 mc. The only problem in their use is mechanical breakage of these plastic cased units. This can be minimized by using the new transistor sockets made for type TO-18 cased transistors since the three leads do not have to be spread out as when using the larger (TO-5 type) sockets. The writer managed to break a few transistors in the first converter built here so a new one, shown in the photographs, was built with the new smaller sockets. No more breakage was encountered but it is a little upsetting to pay as much for a socket as for a transistor. Direct soldering of the transistors into the circuit might be an alternative but makes it hard to select the lower NF transistor for the first rf stage. This arrangement was used finally in the first converter in place of the large sockets though one transistor was damaged in the process of soldering. The small but expensive sockets are really the best solution.

432 mc antenna filter

In **Fig. 1**, a dual circuit antenna filter is shown which was built into an aluminum chassis box 12 x 2¼ x 2½ inches in size. This unit works reasonably well for receiving and for transmitting at low power perhaps up to 50 watts output. With a pair of 4CX250R tubes in the final amplifier, the aluminum box gets hot at the low impedance ends and circuits go out of resonance. The circuits would stay in resonance for a minute or so with 400 to 500 watts of rf power then the box gets warm to the touch and losses go up as the circuits go out of resonance and dielectric losses also increase. Then end result was retirement of this antenna filter to the receiver front end only since its losses, when cold, are approximately one db. The signal loss then is not too objectionable for normal 432 mc signal recep-

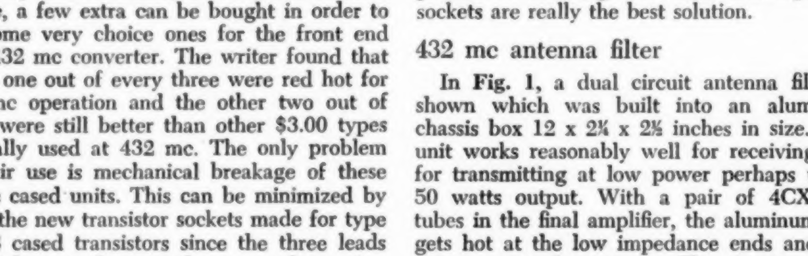
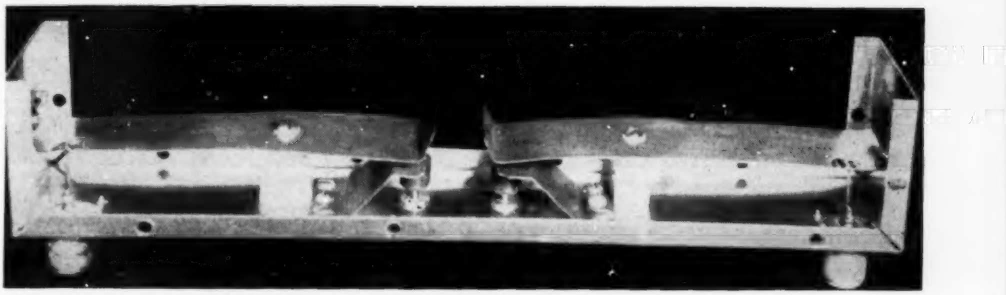

TAP UP ABOUT 3/4" FROM END END (TYPICAL)
COPPER PLATES 1-1/2" WIDE x 6-1/2" LG. (TOTAL) WITH 1/2" LIP EACH END
APPROX. 1/2" GAP
C2
C1
C3
CERAMIC INSULATOR 1/2" DIA x 1" LG.
12"x2-1/4"x2-1/2" ALUMINUM CHASSIS BOX WITH EXTRA LID MOUNTING SCREWS
BAKELITE
BEARING
TYPE "N" COAX FITTINGS
ADJUSTING SCREW
SPRING BRASS PLATES 1-1/2" WIDE x 1-3/4" LG. (TOTAL)

Fig. 1. 432 mc antenna coupler-filter suitable for receiving and low power transmitting use.



432 mc antenna coupler-filter.

tion. The next project at W6AJF will probably be a heavy duty dual coaxial circuit unit built of copper since the writer likes to use high power at 432 mc occasionally. The filter in the transmitter output is highly desirable to nearly eliminate lower and higher order frequencies from getting into the big antenna array. More TVI problems have been encountered here on 432 mc than on 220 or 144 mc band operation, so a good antenna filter is needed. Solid state stereo phonographs and FM band receivers increase the "TVI" problem for many amateur VHF operators.

432 mc converter

At 432 mc, common base rf stages are usually much easier to get into proper operation than with neutralized common emitter systems. The converter shown in **Fig. 2** and in the photographs uses two common base rf stages with forward gain control to set the gain just below oscillation or high regeneration operation. The advantages of forward gain control have been discussed in previous sections on transistor converters. The mixer stage seemed to function best with signal and oscillator injection into the base circuit. Emitter injection was tried but resulted in mixer oscillation due to the added inductance in the emitter lead at 432 mc. The mixer output circuit in **Fig. 2** is a simple tuned circuit since only about .5 mc bandwidth was needed near 14 mc, the if output. If wider frequency coverage is desired, the pi network used in the 144 mc converter, previously illustrated, will cover 4 or 5 mc but with somewhat less mixer gain.

The oscillator uses a 46.444 or a 139.333 overtone crystal with the collector circuit tuned at or near 139.3 mc. The emitter bypass condenser, a small 5 to 25 pf adjustable condenser, permits either type of crystal to be used. It is set for best oscillation in either case. The coupling condenser to the "fast" diode tripler was made adjustable in order to achieve optimum load on the oscillator and maximum output from the diode tripler stage. The 1N914 is a fairly low capacitance high speed computer diode (silicon type) which is better than a 1N82A as a frequency doubler or tripler to 418 mc. It is also suitable for use as back to back protective diodes in the front rf

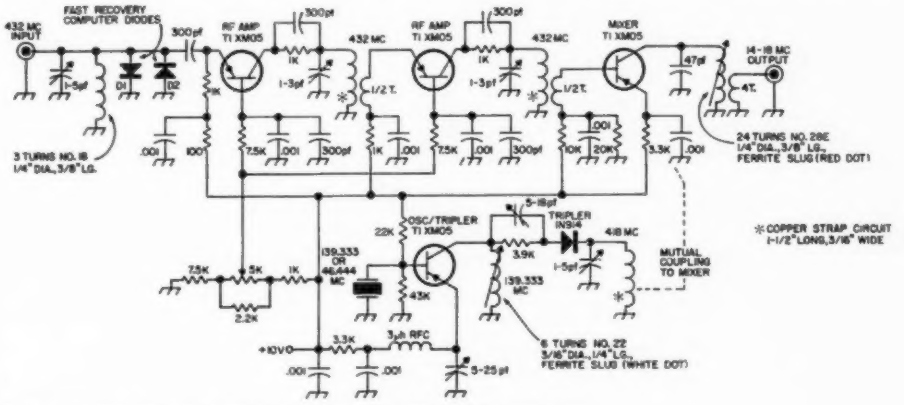
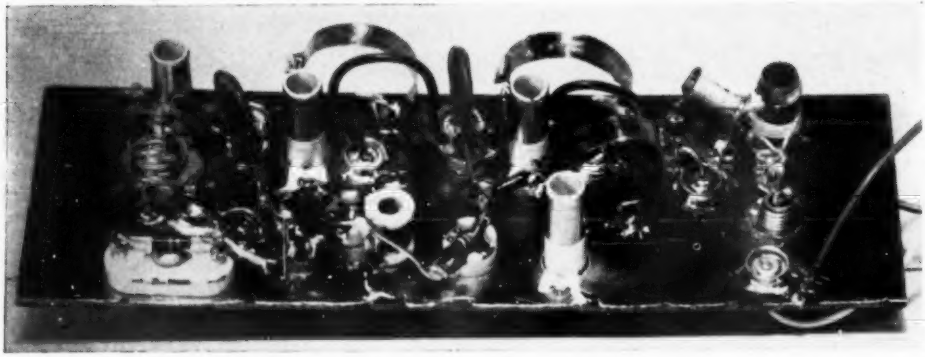

432 MC INPUT
FAST RECOVERY COMPUTER DIODES
1-5pf
D1
D2
3 TURNS NO. 18 1/4" DIA., 3/8" LG.
300pf
RF AMP TI XMO5
1K
.001
100
7.5K
.001
300pf
300pf
1K
1-3pf
432 MC
*
1/2 T.
RF AMP TI XMO5
1K
.001
7.5K
.001
300pf
300pf
1K
1-3pf
432 MC
*
1/2 T.
MIXER TI XMO5
10K
.001
20K
3.3K
.001
47pf
4T.
14-18 MC OUTPUT
24 TURNS NO. 28E 1/4" DIA., 3/8" LG., FERRITE SLUG (RED DOT)
OSC/TRIPLER TI XMO5
22K
43K
139.333 OR 46.444 MC
7.5K
5K
1K
2.2K
+10V
3.3K
3µh RFC
.001
.001
5-25pf
5-18pf
3.9K
139.333 MC
6 TURNS NO. 22 3/16" DIA., 1/4" LG., FERRITE SLUG (WHITE DOT)
TRIPLER IN914
418 MC
1-5pf
*
MUTUAL COUPLING TO MIXER
* COPPER STRAP CIRCUIT 1-1/2" LONG, 3/16" WIDE

Fig. 2. 432 mc low noise converter using 50¢ TIXMO5 transistors.

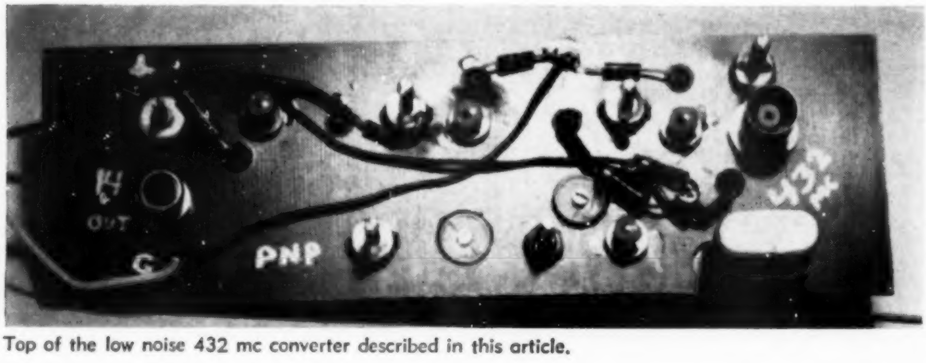


Bottom of the 432 mc converter.

stage though the 4 pf shunt capacitance per diode means some coil turn juggling to keep the input tuned to 432 mc. Type 1N100 diodes were used in the unit shown here since they seemed to have less shunt capacitance and antenna relay leakage from the transmitter wasn't too severe at W6AJF. The coax relay was a hard to find type more suitable for operation in the UHF region than the standard Dow relays available for lower frequency operation at W6AJF. Type N fittings are more efficient at 432 mc and the Dow relays at this station all had the other type of fittings which are suitable for the VHF bands but not as low a SWR rating at UHF.

The grounded base input rf stage has a tendency to oscillate with a change from one antenna to another or to a signal generator. A small variable condenser was shunted across the coax input jack and just enough capacitance added to stabilize this stage. The input coil still has to be adjusted for best NF with a noise generator. The second rf stage will likewise oscillate if the emitter coupling coil is too far away from the 432 tuned copper strap circuit. Too loose coupling will also make the preceding tuned collector circuit working Q value too high and tend to make the converter tune too sharply and be too regenerative. The rf gain control will not function properly if the two rf stages are not loaded correctly and are excessively regenerative. Any 432 mc converter takes a little time and care in adjustment for best weak signal reception. When you get a 432 mc converter into such good operation that occasional auto ignition noise is very noticeable it is probably red hot for 432 operation. It takes a 432 paramp to do better on 432 weak signals. The measured NF of this converter was 4 db which is better than any other transistor converter (except an expensive 2N2857 unit) tested here. It was definitely superior to grounded grid nuvistor and 416B converters tested here on the same noise generator. It would seem that solid state devices are really here to stay. The 4dbNF measured here after a long period of adjustments, is a relative figure since some other noise generator might read a 2 or 3 or 5 db figure. Noise measurements above 200 mc can be very individualistic but are still useful in getting the best NF possible from a converter in the UHF region.

. . . W6AJF



Top of the low noise 432 mc converter described in this article.

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Information on standard frequencies around the world. Don't miss the practical construction article on VLF receivers coming up in 73.

Standard Time and Frequency Transmissions

Sam Kelly W6JTT
12811 Owen Street
Garden Grove, California

WWV is the first station that comes to mind when a ham thinks of a standard time and frequency station. Actually, WWV and WWVH, which are operated by the National Bureau of Standards (NBS), comprise only a few of the world wide standard time and frequency stations which may be of interest to amateurs. **Table 1** lists world wide stations which are classed as "standards" by the International Radio Consultative Committee (CCIR). As you can see, they range in frequency from 14.7 kHz to 25 MHz. Many of them in the high frequency range share the same frequency with other stations, (notably WWV and WWVH) which is why they are difficult to receive in the U.S.

NBS

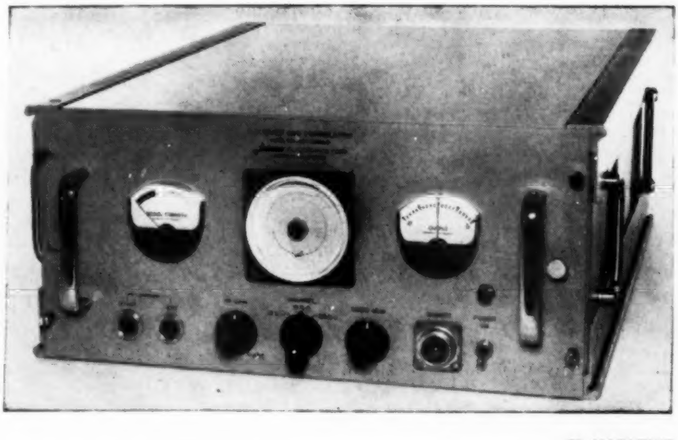
The high frequency services of WWV and WWVH are of most importance to U.S. amateurs. We are all aware of their usefulness for time and frequency spot checks. Actually there are eight technical services provided by HF NBS stations. The services of most interest to Hams are the standard audio and radio frequencies, time announcements, propagation forecasts and geophysical alerts.

Standard audio frequencies of 440 and 600 Hz are broadcast by WWV and WWVH. The 440 Hz note is the standard A above middle C for the music industry. The audio frequencies are transmitted alternatively at five minute intervals starting with the 600 Hz tone on the hour. The first tone period transmitted by WWV is three minutes long, with the remaining periods being two minutes in length.

All WWVH tone periods are three minutes in length. The pulse or "Tick" consists of five cycles of 1000 Hz tone from WWV and six cycles of 1200 Hz tone from WWVH.

Carrier stability is maintained within five parts in 10^{11} (which amounts to an error of 0.00005 Hz on the 25 MHz carrier). The transmitter's oscillator is correlated with the Cesium standard at NBS.

Propagation notices are transmitted during



A typical VLF receiver and correlator for submarine installation. This unit is built by Interstate Electronics for use on nuclear submarines. The receiver electronically compares a precision standard oscillator in the missile instrumentation timing system with the VLF signal. Accuracies of three parts in 10 billion are easily obtained in a few hours of observation.

the last half of every fifth minute of each hour. The forecast is transmitted in MCW. The following scale is used.

1 Useless
2 Very Poor
3 Poor
4 Poor to Fair
5 Fair
6 Fair to Good
7 Good
8 Very Good
9 Excellent

Signals classed between 1 and 4 are called "disturbed" (W), 5 is "unsettled" (U) and 6 through 9 are "normal" (N). A forecast consists of a letter and a number. The letter designates current propagation conditions while the number is the forecast for the next six hours. An example would be U 7. This would mean that current conditions are unsettled, but that they are expected to improve to "good" within the next six hours.

During the International Geophysical Year (1957-58) a series of geophysical alert symbols was established to provide a world wide warning system for events of geophysical significance. The following symbols are used:

C Cosmic ray event
E No alert
M Magnetic storm
N Magnetic quiet
Q Solar quiet
S Solar activity
W Stratospheric warning

These signals are transmitted in code 19 minutes after the hour from WWV and 49 minutes after the hour from WWVH.

You have probably heard a "burring" sound while listening to WWV. This is a special time code transmission of Universal Time (UT). It is broadcast for a one minute period ten times an hour only on WWV. The main use of this code is for standardizing time at observatories and missile test ranges. The code consist of a 100 PPS 36 bit serial pulse train containing day of year, hour, minute and second. To record this time signal you need an oscillograph recorder connected to the output of your receiver. A detailed description of the code, and the various high frequency services, is contained in National Bureau of Standards Miscellaneous publication 236 which is available from the Superintendent of Documents.

Foreign standard transmissions

Foreign standard transmissions aren't well known in the U.S. Many of them in the HF range share frequencies with WWV and WWVH. They are plagued with illegal transmissions on their frequencies just as we are in our ham bands. An effort is being made to get all governments to cooperate in closing down the bootleggers.

FREQUENCY	CALL	LOCATION
14.7 kHz	NAA	CUTLER, MAINE
16 kHz	GBR	RUGBY, ENGLAND
18 kHz	NBA	CANAL ZONE
18.6 kHz	NPG	JIM CREEK, WASH.
19.8 kHz	NPM	LUALUALEI, HAWAII
20 kHz	WWVL	FT. COLLINS, COLO.
22.3 kHz	NSS	ANNAPOLIS, MD.
50 kHz	OMA	PODEBRADY, CZECH.
60 kHz	WWVB	FT. COLLINS, COLO.
77.5 kHz	DCF 77	MAINFLINGEN, GERMANY
100 kHz	RGS	MOSCOW, USSR
200 kHz	—	DROITWICH, UK
200 kHz	RW 166	ANGARSK, USSR
1 MHz	SAZ	ENKOPING, SWEDEN
1.5 MHz	—	STOCKHOLM, SWEDEN
2.5 MHz	FFH	PARIS, FRANCE
	JJY	TOKYO, JAPAN
	MSF	RUGBY, ENGLAND
	OMA	PRAGUE, CZECH.
	WWV	GREENBELT, MD.
	ZLFS	LOWER HUTT, NEW ZEALAND
3.330 MHz	CHU	OTTAWA, CANADA
5 MHz	BPV	SHANGHAI, CHINA
	HBN	NEUCHATEL, SWITZERLAND
	IAM	ROME, ITALY
	IBF	TORINO, ITALY
	JJY	
	LOL	BUENOS AIRES, ARGENTINA
	MSF	
	RWM	MOSCOW, USSR
	WWV	
	WWVH	MAUI, HAWAII
	ZUO	JOHANNESBURG, SOUTH AFRICA
	ZUO	OLIFANTSFORTEIN, SOUTH AFRICA
7.335 MHz	CHU	
10 MHz	ATA	NEW DELHI, INDIA
	BPV	
	JJY	
	LOL	
	MSF	
	RWM	
	WWV	
	WWVH	
	ZUO	
14.670 MHz	CHU	
15 MHz	BPV	
	JJY	
	LOL	
	RWM	
	WWV	
	WWVH	
20 MHz	WWV	
25 MHz	WWV	

Table 1. International time and frequency stations.

Table 2 is a list of hourly modulation schedules for the most prominent foreign stations.

VLF transmissions

The high frequency transmissions are more than accurate enough for ham use. However, due to propagation instabilities they are not good enough for today's missile work.

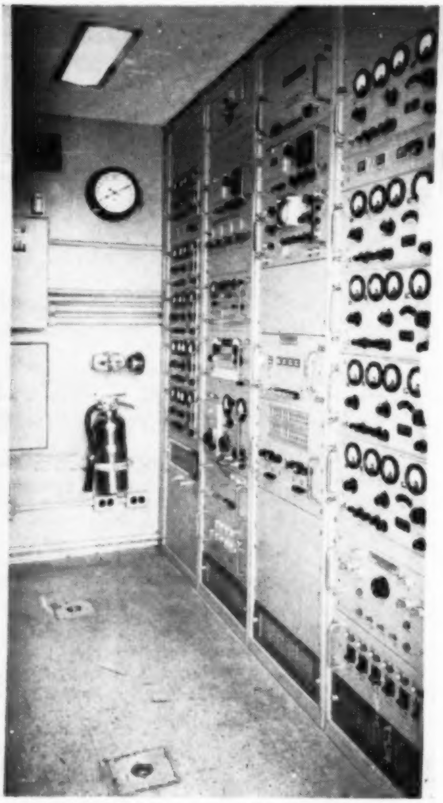
In order to achieve a frequency of one part in 10^{10} it was necessary to average HF transmissions for a period of weeks. Now, using VLF transmissions, it is possible to achieve this accuracy in a single day's observation—anywhere in the world! This is due to the fact that the VLF transmissions follow the curvature of the earth as if the surface of the

A typical standard frequency receiver manufactured by Gertsch. It is fully transistorized and receives the Canadian CHU signals in addition to WWV/WWVH. Audio frequency filters are provided for 440, 600 and 1000 Hz tones. Provision is included for oscilloscope monitoring of beat frequencies.

earth and the Ionosphere form a gigantic waveguide.

VLF has an added strategic advantage in that it penetrates water and can be received by submarines while they are submerged. Several of the VLF stations in **Table 1** (Those with a "N" prefix) are primarily for world wide communications with submarines. Due to their low frequency they are somewhat immune to ionospheric disturbances, and due to their high power relatively free from jamming. Their frequency is precisely controlled and correlated with the United States Frequency Standard (USFS).

. . . W6JTT



Gertsch Standard Frequency Receiver installed in a missile tracking van.

Call	**Signal Format**
ATA	Pulse or tick consists of five cycles of 1000 Hz tone, lengthening to 100 ms at the beginning of each minute. Call sign and time in MCW every quarter hour.
FFH	Pulse consists of five cycles of 1000 Hz tone. Minute pulse lengthened to 100 ms followed by 200 ms of 440 Hz tone. Announcement in MCW every 20 minutes with a five minute silent period between the 20 and 25 minute.
HBN	Carrier interrupted five times per second for 1 ms. Call sign in CW at 5, 15, 25, 35 and 45 minutes past the hour.
IAM	Pulse of five cycles of 1000 Hz tone repeated four times at the minute. Call sign in MCW and voice identification every fifteen minutes.
IBF	Pulse of five cycles of 1000 Hz tone repeated 7 times at minute. 1000 Hz tone from 5 to 10 minutes. Silent period from 30 to 50 minutes. Call sign in MCW at 10, 20 and 30 minutes. Voice identification at half hour.
JJY	1000 Hz tone with second pulses throughout hour except for silent period from 30 to 40 minutes. Announcement in MCW (includes propogation notice) and voice identification every five minutes.
LOL	Alternating 1000 and 440 Hz tones for five minute periods with voice and CW announcements every five minutes. Second pulses transmitted between 55 and 60 minutes.
MSF	Alternating five minute periods with first period consisting of second pulses, second period no emission. Announcement in morse and voice every 10 minutes.
OMA	Five minute period of 1000 Hz tone on hour, 15, 30, and 45 minutes. Carrier only from 20 to 25 minutes. Call in morse every 15 minutes.
ZUO	Second pulses of five cycles of 1000 Hz tone from 0 to 15 minutes. No emission from 15 to 25 minutes. Second pulses resume at 25 minutes. MCW announcement every 15 minutes.

Table 2. Programs of miscellaneous stations.

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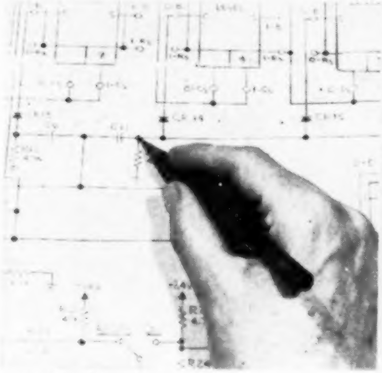

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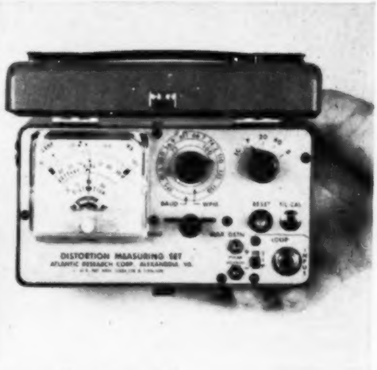
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OUTPUT
1 KC
OFF
2 KC

Jim Fisk WA6BSO
Peterborough, N.H.
Photos by Jim Harvey WA61AK

A Simple Two Tone Test Generator

As most single sideband enthusiasts know, the simplest and easiest way to properly adjust a linear rf amplifier is with a two-tone signal generator. With an oscilloscope and two audio frequencies about 1000 cycles apart it becomes a relatively simple task to adjust loading, drive and grid bias for maximum linearity. The transistorized two-tone generator described in this article was designed to provide the simplest possible generator which will supply the required audio signals at a minimum cost.

Two-tone audio generators that have been described in the past have used bulky inductors and capacitors in an LC circuit, but the straight-forward phase-shift circuits used in this unit maintain good stability and low distortion with two 50¢ transistors and the simplest of bias arrangements. The secret to this phase-shift oscillator's stability is the low value of collector load resistance used; this resistance effectively swamps out any changes in forward current gain that may exist between transistors of the same type. This means that the amplitude of the output signal will remain relatively constant regardless of the transistor that is used. Actually, the only requirement for the transistors is that they have high beta (h_{fe}). Many different types of PNP transistors have been tried in this circuit; some work and some don't, but both 2N2953's and 2N2613's (50¢ varieties) have been used successfully. Some of the older types—such as the 2N107—will not oscillate in this circuit because they don't have

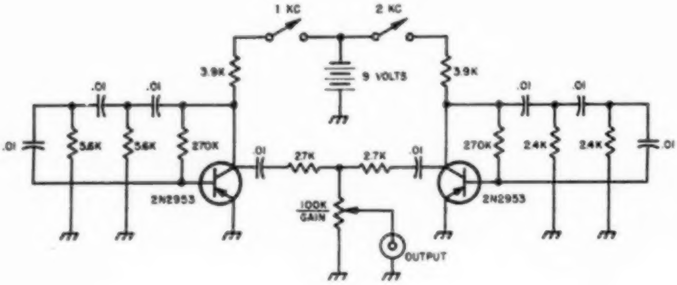


Fig. 1. Schematic of the two tone test generator.

quite enough gain. This circuit is not limited to PNP types; silicon NPN transistors like the 2N3391 work quite well if you reverse the polarity of the battery.

With a new nine volt battery, the audio output from this unit is adjustable from about five volts peak-to-peak down to several millivolts. This is more than sufficient for nearly any application requiring this type of a signal. Since the total current drain for this unit is only three milliamps, even with both oscillators going, the life of the battery is just about its normal shelf life. The output decreases accordingly, but this circuit will continue to oscillate with as little as 1½ volts applied. This means that this unit will provide a useable output even when the nine volt battery is four or five years old!

Construction and layout of the circuit is anything but critical. In the unit in the photographs, the active circuitry was laid out on a piece of Vector board (32AA18), 2 inches wide and 3½ inches long. This is quite a bit larger than necessary, but in the author's model, junk box parts were used. If one-quarter watt resistors and miniature capacitors are used, the total size could be easily cut in half. However, miniaturization can go *too* far. If an instrument of this type is made as small as physically possible, there's no room on the front panel for the switches, knob, and output jack! The 2⅛ X 2¾ X 4 inch LMB type J-875 Jiffy-Box seems to be a good compromise. It is small enough not to be obtrusive, but large enough so you can operate the controls. After laying the components out on the punched board and wiring them together, the whole assembly is glued to the back-end of the output potentiometer with epoxy glue. The end result is an integral, easily installed package. Granted, it's pretty tough to replace any of the components when everything is glued together, but after all, transistors last nearly forever and the other components in the circuit are operated so far below their ratings that they should last nearly as long. The battery clip is formed from thin Reynold's aluminum sheet and epoxied to the side of the Jiffy-box as shown in the photograph. The toggle switches are miniature Japanese types that are available for 29¢ apiece.

As was previously mentioned, the two-tone audio generator is especially useful when adjusting linear rf amplifiers for maximum linearity and minimum intermodulation (IM) distortion. Since the procedure for making the necessary adjustments is quite simple and has been liberally discussed in various literature*, it won't be unnecessarily recounted in this article.

In addition to linearity adjustments and measurements, the two-tone audio generator is useful in determining the peak envelope power of an amplifier. The mathematical relation that is helpful in this respect was originally provided by Breune* and may be expressed as follows:

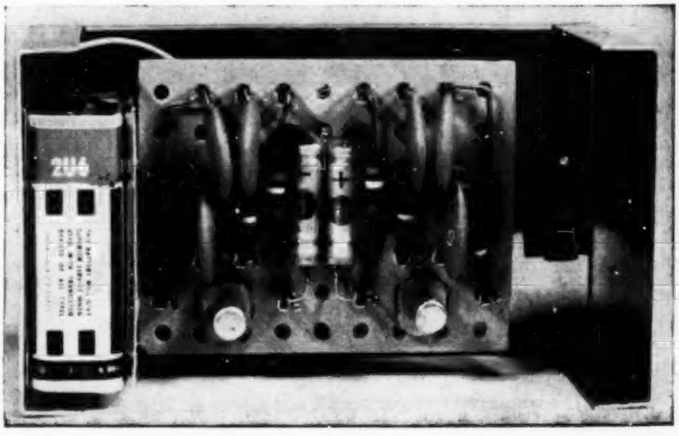
$$I_{pk} = I_{dc}\,(1.57 - 0.363\, I_o)$$

Where: I_{pk} = Peak plate current
I_{dc} = Plate current with two-tone signal
I_o = Zero signal plate current

---

* E. W. Pappenfus, *Single Sideband Principles and Circuits*, McGraw-Hill, 1964, Chapters 12 and 22.
Single Sideband for Radio Amateurs, ARRL, 1962, pp. 133-150.
Don S. Stoner, *New Sideband Handbook*, Cowan, 1958, Chapter 6.

** W. B. Breune, "Linear Power Amplifier Design," Proceedings of I. R. E., December 1956.



Inside view of the two tone test generator. Note the position of the battery bracket on the left side.

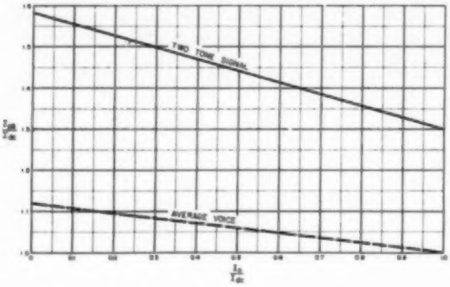


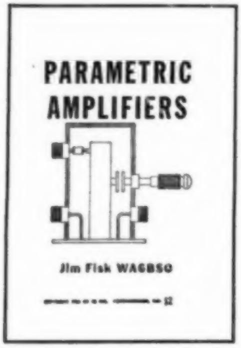
Fig. 2. Peak plate current ratings.

All this equation says is that if we know the zero signal plate current (I_o) and the plate current with the two-tone signal (I_{dc}), we can readily compute the *peak* plate current. Once the peak plate current is known, the peak envelope power may be calculated by simply multiplying the peak plate current times the voltage at the plate of the tube. The importance of the mathematics is that we are able to compute the peak plate current of the final even though we are measuring *average* values of I_{dc} and I_o. Since hams as a rule have always had a dislike for mathematics, the solid line in **Fig. 2** was plotted to show this important relationship in a straight-forward, easy to use form. It is important to point out that this solid line is the peak plate current with the two-tone audio signal and does not apply when the transmitter is modulated by a human voice. With a voice signal the peak envelope power is less than with the two-tone signal because of the lower duty cycle; the exact amount depends upon the vocal characteristics of the operator. However, experience has shown that it averages about 40% of the two-tone current. This is represented by the dotted line in **Fig. 2.**

The use of this chart requires a minimum of arithmatic yet provides the desired answer in short order. When the zero signal plate current (I_o) and two-tone plate current (I_{dc}) are known, their ratio is easily calculated by dividing I_o by I_{dc}. This ratio is important because it determines the entry point to the chart from the lower horizontal axis. If a line is projected straight up from this entry point, it will intersect both the "Two-tone signal" and "Average voice" lines. The point of intersection determines these respective peak plate currents as indicated on the left-han axis of the chart in the form of a ratio to I_{dc}.

Perhaps the easiest way to illustrate the use of this chart and the ultimate determination of peak envelope power is through a typical example. Assume that after an amplifier has been adjusted for proper linearity, the indicated plate current with the two-tone signal is 300 ma. With the two-tone generator off the zero signal idling current is 60 ma. Therefore, the ratio I_o/I_{dc} is found by dividing 60 by 300 or $60/300 = 0.2$. Entering the chart at 0.2 and projecting straight upward, an I_o/I_{dc} ratio of 0.2 corresponds to an I_{pk}/I_{dc} ratio of 1.46. The peak plate current is then 1.46 times 300 ma or 438 milliamps peak. With 2000 volts on the plate, this amplifier is running at 876 watts peak (two-tone). With the lower duty cycle of voice modulation the peak power would be about 40% of this or 350 watts. However, since the dotted line predicts the plate current with voice modulation, the voice power may be reached directly by using and dotted line of **Fig. 2** where an I_o/I_{dc} ratio of 0.2 corresponds to an I_{pk}/I_{dc} ratio (average voice) of 0.584; 300 ma times 0.584 is 175 milliamps. Power input with voice modulation then is equal to 2000 volts times 175 ma or 350 watts, the same result as before.

. . . WA6BSO



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A "Second Chance" Crystal Filter for the BC-348

The BC-348 J, N and Q series general-coverage receiver was, and is, one of the best bargains in surplus. Although it has many attractive features, its lack of selectivity is its most serious drawback. The modification described in this article converts the ol' reliable plow-horse into a sensitive thoroughbred. With the vastly increased selectivity, you'll be able to get solid copy through noise and QRM that would normally obliterate the signal.

After putting up with the problems involved in using an outboard Q-5er, we became more convinced as time went by that the crystal filter in the BC-348 ought to do more than to act as a "high-low" gain control switch. We decided to give the crystal filter a second chance and rewired it in a different configuration. The performance of the filter made a dramatic change in the selectivity of the receiver. In fact, AM phone men may find it a little too sharp for their liking. CW ops and sidebanders will find it a pure delight.

Fig. 1 shows the original circuit of the filter; Fig. 2 shows the modified circuit. L1 is a slug-tuned coil salvaged from a BC receiver if transformer; L2 is the coil originally used in the grid circuit of the 2nd if amplifier of the BC-348. C1, C2 and C3 are "postage stamp" mica capacitors; C4 is a mica compression trimmer.

Don is an electrical engineer. His main interest is RTTY, and he thinks he was the first US amateur to operate legally in Italy after WWII. He operated from December 1945 to January 1946 from the AAF base at Capodichino on the 7000-7025 kc band.

First, remove the crystal from the BC-348 for cleaning and testing. To test the crystal for activity, link-couple it to a grid-dip meter with a 15-20 turn coil and watch for a very sharp dip when tuning through 915 kc, the crystal frequency. The dip need not be great, but there must be some indication of resonance. Our first results of this test were disappointing. When we opened the crystal, we found that wax on the outside has softened and seeped inside, coating the crystal and pressure plates. After scraping the wax from the outside, carefully cleaning the crystal itself and the interior of the holder, and reassembling, it resonated very nicely.

The next step is to select for L1 a suitable inductor that can be tuned to 915 kc (the if frequency of the BC-348) and that can be mounted adequately on the chassis. We used a small 456 kc if transformer coil assembly that had two pie windings at each end. The coil

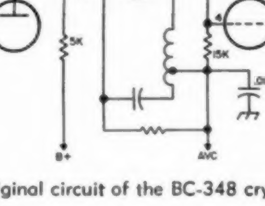


Fig. 1. Original circuit of the BC-348 crystal filter.

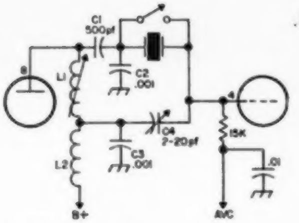


Fig. 2. Modified circuit.

form, a fiber tube, was cut in half and eventually mounted by force fitting one end into a plastic cup which was, in turn, mounted to one of the unused socket ground lugs with a small self-tapping screw. Using a grid-dip meter, remove enough of the winding to resonate the coil at 915 kc with C1, C2 and C3 connected in series across it.

If desired, L2 may be left in place on the fiber mounting plate just below the crystal. However, it is not difficult to remove and is easier to work on if pulled out temporarily. Remove wires and excess solder from the terminals, then prewire 4 inch leads to the two terminals at the end nearest the mounting studs before replacing the coil. The other terminals are unused.

Remove the plate load resistor and the 100 pf coupling capacitor connected to pin 8 of the 1st if amplifier (6SK7) as well as the 35k resistor connected diagonally across the top of the fiber subchassis. Rewire the filter as shown in **Fig. 2.** The capacitors all may be lead-supported. Recheck your wiring before applying power.

To align the modified receiver, first turn the crystal switch to OUT (thus short-circuiting the crystal) and operate the power switch to MVC. Then, tune the receiver to any unused frequency and peak the tuning slug of L1 for maximum noise output from the loudspeaker. The next steps are aimed at aligning the whole if chain of the receiver to match the resonant frequency of the crystal. Operate the crystal switch to IN and turn on the BFO. Next, adjust the phasing capacitor C4 until the general background noise subsides and all that is left is a "tinny" ringing sound. Then, peak up the adjustment screws on the top and bottom of each of the if transformers, as well as L1, for maximum loudspeaker output. Repeat, as necessary, until all adjustments are peaked up. You will notice that even background noise will have a definite musical pitch as the BFO knob is swung through either side of zero beat. This completes the alignment.

Once the receiver has been modified, you'll find that more skill is needed in handling the tuning of the receiver to realize the most from the extremely sharp selectivity you now have at your fingertips. An important thing to remember is that the receiver "looks" at a very narrow slot of the frequency spectrum. The center frequency of this slot is controlled by the main tuning control–not the BFO control. Noise or signals outside this slot will not pass through the crystal and, thus, will not appear at the loudspeaker.

The secret of proper tuning, in the case of a CW signal, is simply to match the pitch of the signal to the pitch of the background noise. With the crystal filter in, adjust the BFO to one side of zero beat so that the background noise has a noticeable pitch. Then carefully tune across a CW signal. You will notice a distinct "yoop" when the signal slides into the bandpass slot. Depending on whether the BFO control is on the high or low side of zero beat, the resonance will be in the upper sideband or the lower sideband. Once you have the signal pinned down with the main tuning control, you can then adjust the BFO for a pleasing pitch. For a real surprise, tune in a weak CW signal in a crowded band. Then switch the filter out and listen to the QRM and QRN pile in. Switch the filter back in again and enjoy solid copy. The filter can be used for the reception of phone signals too. Although the audio quality is poor, the intelligibility of the signals is higher because the filter blocks out interference and noise.

The circuit is simple but very effective. Basically, it solves two problems: matching the high plate impedance of the 1st if amplifier to the low impedance of crystal circuit; and, providing a means for exactly balancing out the residual capacity of the crystal holder. L2 acts as an rf choke which is self-resonant at the if frequency. This keeps both ends of L1 "hot" to ground. The instantaneous polarity of the ends of L1 will be 180° out of phase, however, C1, C2 and C3 act as an impedance matching network as well as providing a push-pull source of signals that is balanced with respect to ground. For the moment, consider the effect when the crystal is removed from its holder. Then, with the phasing condenser adjusted to just equal the capacity of the crystal holder capacity, the "bridge" will be balanced and no signals will reach the grid of the 2nd if amplifier. That is, the signals leaking through the holder capacity will be exactly balanced out by the out-of-phase signals leaking through the phasing capacitor. Now, if the crystal is put back in its holder, it will permit only signals which coincide with its series resonant frequency to pass through and be amplified.

. . . K2ZZF

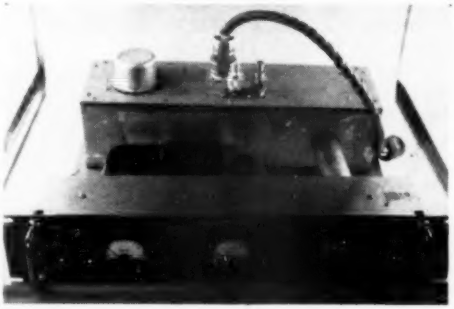
Rear of the APA-2 preamp. The blower, connectors, 6BQ7 and 416B can all be seen with the cover off.

Mel Pfeffer W5LTR
1100 Maxime NE
Albuquerque, N.M.

APA-2 Preamp for Two

The APA-2 preamp can be found on MARS and surplus lists and seems to be missed by a lot of VHF hams. This unit can be one of the most important components for VHF DX work. There seems to be little or no information as to its original use but has high gain and low noise for 2 meter through 432 mc. The units found locally on surplus were all manufactured by the Applied Science Corp. and ranged from 200 to 300 mc in their original form. The APA-2 consists of a power supply unit and the preamp chassis. The power supply unit is completely metered for heater voltage, plate current and plate voltage. Each circuit is adjusted on front panel for a varying voltage and current applications. Besides the ON/OFF switch there is a switch for leaving the blower on the preamp chassis running while all voltages are removed from preamp during stand by. Preamp chassis units contain a 416B and 6BQ7 follower. No modifications or changes are required in the power supply unit. The power supply is rack mounted for 19"x3½" and makes a neat panel arrangement with the pre amp unit. The connecting cable, if you were lucky to get it, can be lengthened or shortened to meet your needs in mounting. As the photo shows the preamp contains the following items: 416B with tube socket, 6BQ7, and coils in an RF box. It is cooled by a 110VAC blower and the antenna input and preamp output connection can be seen. The units here for local hams have been charged to 2 meters in the following way. The antenna input coil in the cathode of the 416B was removed and replaced with 4 turns #18 on ⅜ ID form. The coil is tapped up 2½ turns from ground and connected to an input terminal. Next the plate coil of 416B was removed. This was replaced by a ½" slug turned form. The mounting hole for the coil form had to be enlarged to hold the ½" coil form. On this is wound 5 turns of #18. One end of coil goes to the 416B plate and the other end goes to B+ for the 416B. The original circuit here is coupled to 6BQ7A by a 56 pf capacitor. I have found that if only the 416B is to be used, a two turn loop at plate end of the 416B plate coil form would couple to the output. If the 6BQ7 follower is to be used the signal is coupled by the 56 to the 6BQ7A. The plate coil of 6BQ7 is broad enough and no changes here proved necessary. The output coil at the preamp output connection is 4 turns of #18 tapped 2½ turns up from ground. The RFC chokes can be changed from Z235 to Z144. The plate coil of 416B and 6BQ7A are tuned to a band pass of 135 mc to 150 mc with a peak at 145 mc. The basic schematic is the same as shown in various VHF handbooks and no changes in values are needed. The first unit was finished and installed at WSKDT and proved its worth. With a 417A converter and 10 element 2 meter beam, signals from outside of town came up 25 db over the signal without the preamp. Signals here at W5LTR came up 23 db with Park Nuvistor convertor. The units are selling for $15.00 locally with power supply when available. Hope to hear you on two.

. . . W5LTR



Front view of the APA-2 power supply with the preamp in the rear.

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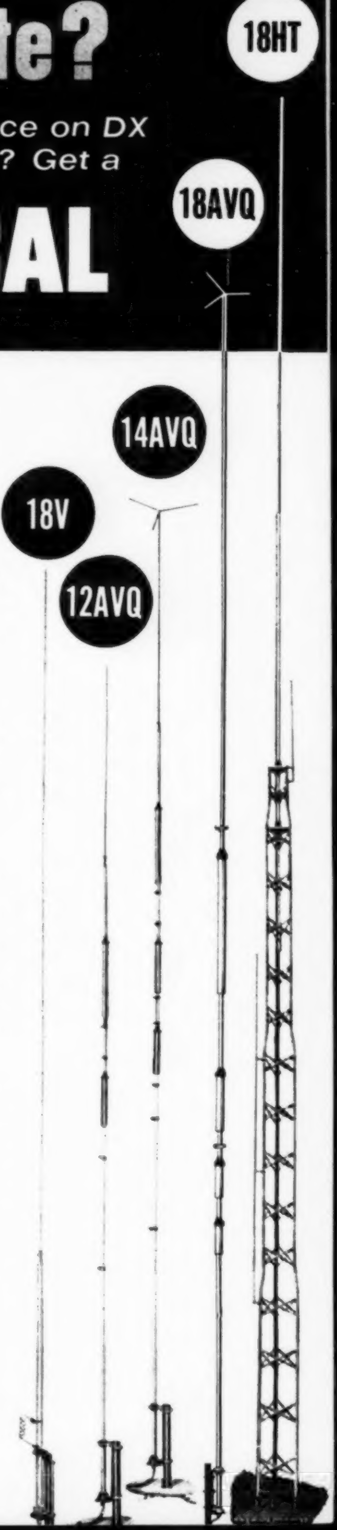

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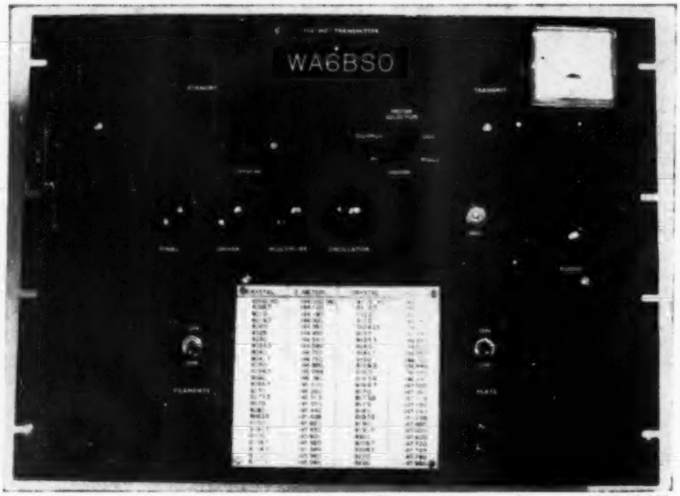

Photos by Jim Harvey WA6IAK

Jim Fisk WA6BSO
1560 Glencrest Court
San Jose, California

Modernizing the SCR-522 Transmitter

Today the easiest way to get on 432, or 1296 for that matter, is to start out with 10 or 12 watts on 2 meters and multiply up. Many different transmitters that meet these requirements have been described, but apparently the erstwhile SCR-522 has been all but forgotten. Back in the late 40's and early 50's just about everyone was using this versatile transmitter on two meters. Consequently they are plentiful, inexpensive, and when properly modified, still fulfill the requirements nicely. As to cost, the unit converted by the author was obtained from an ex-novice complete with power supply for ten dollars.

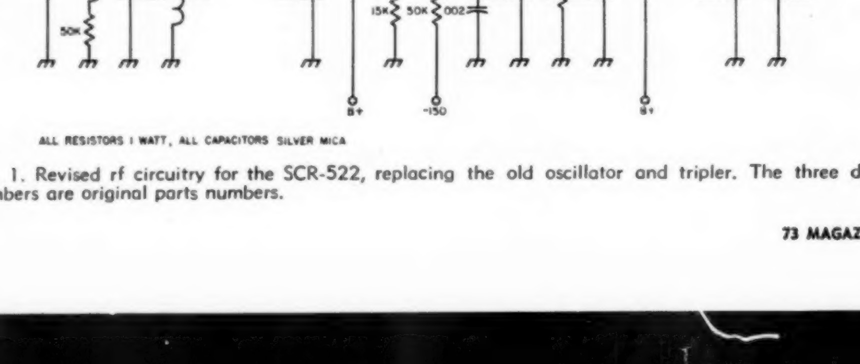
16 mc
100 pf
48 mc
20 pf
6AQ5A
6CL6
10 pf
114
118
115
119
50
50K
22K
20 pf
8 MC XTAL
RFC
50K
.002
RFC
.002
50K
.002
A
15K
50K
.002
.002
2K
.002
.002
.002
B+
-150
B+
ALL RESISTORS 1 WATT, ALL CAPACITORS SILVER MICA

Fig. 1. Revised rf circuitry for the SCR-522, replacing the old oscillator and tripler. The three digit numbers are original parts numbers.

There are probably many reasons why the old −522 lost its popularity, but TV interference was no doubt near the top of the list. We have learned a lot about TVI in the last 15 years, but many hams still tend to be afraid of the −522 because of TVI problems. In as much as this transmitter has been used nightly over a period of six months with no complaints whatsoever, these fears are apparently unfounded, at least with this modernized unit. However, considering that it was designed just prior to World War II for aircraft communications service, it is antiquated by todays standards. Fortunately it is quite easy to bring it up to date, and even in the modernized state still provides one of the cheapest ways to get on two meters.

Actually the SCR-522 is a complete receiver/transmitter, consisting of a BC-625 transmitter and a BC-624 receiver. However, for the purpose of this article we are considering only the transmitter portion of the unit. The BC-625 transmitter is a crystal controlled, plate modulated AM transmitter capable of operating anywhere between 100 and 156 m.c. These units were manufactured continuously for several years, and it is not at all unusual to find small differences from one model to another. Essentially however, the transmitter starts out with a straight-forward crystal oscillator; this circuit is controlled by an 8 mc crystal and provides an output signal at 16 mc. The 16 mc signal is then tripled in a standard tripler circuit to 48 mc and fed to the 832A tripler-driver. The 144 mc output of this circuit drives the final 832A amplifier to about 12 watts output on two meters. The modulator portion of the transmitter starts out with a carbon microphone (with its attendant battery and transformer), feeds the audio signal through a driver stage and finally to the push-pull output.

The modernization of the rf section of the transmitter discussed in this article consists primarily of changing the tube types used in the first two stages; the 832A driver and power amplifier are retained. These last two stages could be modernized to a pair of 6146's, a 5894, or even an 829B, but it would really serve no useful purpose. The 832A is available on the surplus market, provides a pretty potent punch and the price is right. However, the modernization of the modulator section is a completely different story. This circuit is completely revamped for use with a crystal microphone using modern tubes and components.

The first step in this modernization is the complete rehabilitation of the audio section. Since this section is going to be completely rebuilt, strip out all the octal tubes, sockets and associated components; remove the microphone transformer (#158)*, the driver transformer (#159) and the 250 ohm audio control (#125). Also remove the −150 volt bias line that goes to the center tap of the driver transformer and cut it off where it terminates at the resistor terminal board.

Cut a piece of thin sheet aluminum, laid out as shown in **Fig. 5**, and install it in the audio compartment of the −522. This mounting plate has been laid out so that each of the new tube sockets fit into the old octal cutouts. The only holes that have to be drilled in the −522 chassis are the four mounting holes at the corners of the aluminum sheet. After installing the tube sockets, wire the unit accord-

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* **NOTE**: The three digit numbers given in the parenthesis and shown in the schematics refer to the three digit numbers stamped on or near the respective -522 components.

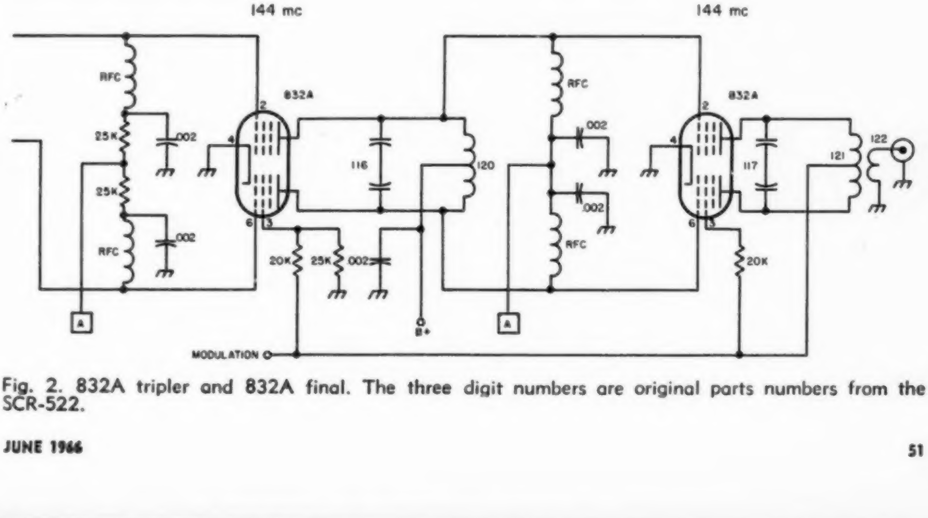


Fig. 2. 832A tripler and 832A final. The three digit numbers are original parts numbers from the SCR-522.

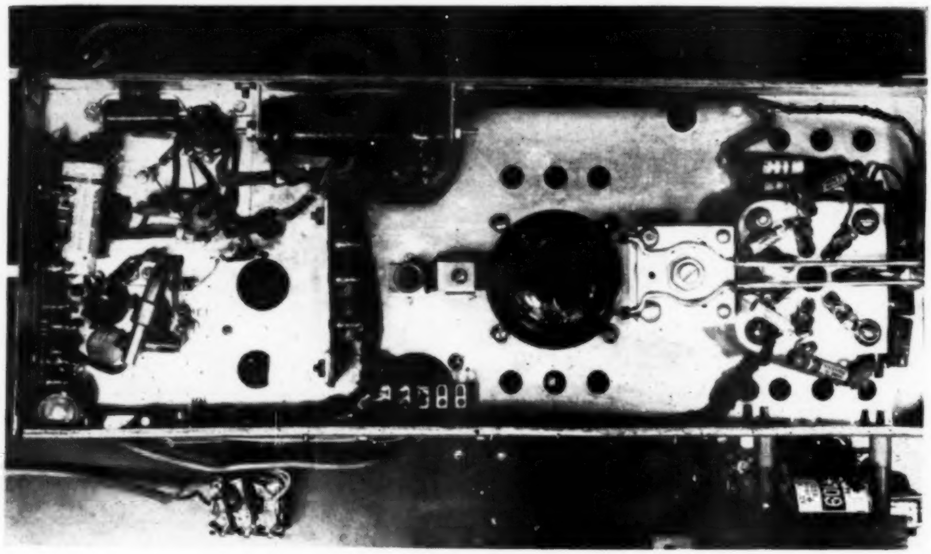
ing the schematic of **Fig. 3**. Parts layout is not critical except for the input to the first 12AX7. Care must be taken here to use short leads to prevent rf feedback. Other than this precaution, the audio circuitry is quite straightforward. Most of the components may be mounted on the terminal strip at the bottom end of the chassis or at the tube sockets. The 500 K audio control is mounted in the chassis hole vacated by the old 250 ohm pot. Cut the shaft on this control so it is 1⅜ inches long; this will provide sufficient length when the front panel is installed. In the original design of the −522, wiring to the audio control and microphone jack was routed through a piece of tubing which is attached to the chassis. In this modernization, the wiring is still routed through the tubing, but shielded grid wire is used for added isolation.

If more than 275 volts is going to be used, a dropping resistor (R_x in the schematic of **Fig. 3**) must be placed in series with the high-voltage line to the audio compartment to prevent damage to the audio tubes. The complete audio section requires 75 mils of current so the value of this resistor may be determined by Ohm's law; just subtract 275 from the supply voltage and divide this difference by 75 ma. In the author's case where 425 volts is used, a 2000 ohm, 20 watt wirewound resistor was used.

After the modulator is completed, the crystal oscillator and first tripler stages must be converted to modern tubes. In these two circuits all that is replaced is the tubes themselves, the rest of the circuitry is identical to the original design. First of all, remove the two tubes and octal sockets in the final amplifier compartment. When removing the various connections from these sockets, use a soldering tool so that the existing capacitors, resistors and wiring are retained. In a few cases the lead lengths will be too short for use with the new 6AQ5A oscillator/doubler and 6CL6 tripler, but the existing parts are used as much as possible. When removing the leads from the octal sockets, it's a good idea to label each one as it is removed. Short pieces of masking tape may be attached to each lead and appropriately labeled. If this is done it will be a lot easier to wire the new sockets when they are installed.

When the octal sockets are pulled out and the circuitry is exposed, it's a good idea to replace all of the old mica bypass capacitors with modern high-quality units. This is not absolutely necessary, but it will preclude any future problems with these old capacitors. It's a little easier to replace them now than wait until the chassis is all buttoned up. This is also a good time to rewire the 832A filament circuits for 6.3 volts. This is accomplished by removing the existing ground on pin 7 of the 832A sockets, wiring pins 1 and 7 together, and tying pin 5 to ground. This is a little difficult to do on the 832A tripler/driver, it *can* be done. The new tubes are all wired for 6.3 volt filaments during the initial installation; this is shown schematically in **Fig. 4.**

Now cut a small aluminum sheet as laid out



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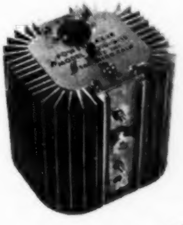

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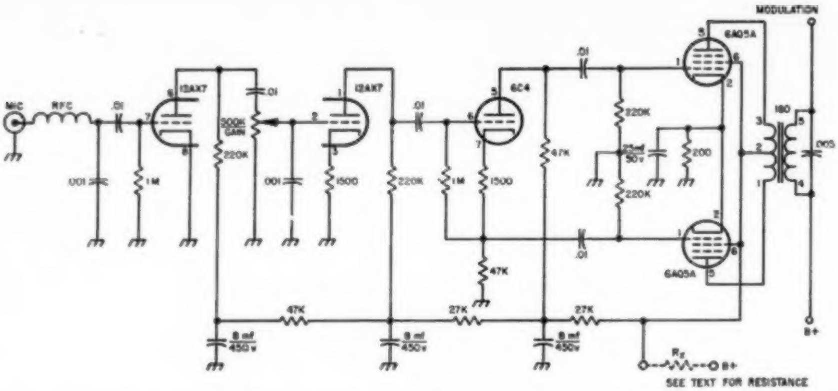

MODULATION
MIC
RFC
.01
.001
1M
12AX7
.01
300K GAIN
220K
12AX7
.001
1500
.01
220K
6C4
1M
1500
47K
.01
220K
25mf 50v
200
220K
6AQ5A
180
.005
.01
6AQ5A
47K
47K
27K
27K
8 mf 450v
8 mf 450v
8 mf 450v
Rx
B+
B+
SEE TEXT FOR RESISTANCE

Fig. 3. New modulator to replace the original modulator designed for carbon mike input.

in **Fig. 6** and install the tube sockets for the **6AQ5A** and **6CL6.** Install this aluminum plate in the final amplifier compartment and wire the sockets according to the schematic (**Fig. 1**), using the components that were labeled when the octal sockets were removed. Since the new circuitry uses approximately the same layout as the old octal circuit, no trouble should be experienced. However, in some cases new components will have to be substituted because the leads on the old parts are too short.

In addition to the normal circuit wiring, install two wires about three inches long, one to pin 7 of the 6AQ5A, the other to ground; these wires will eventually be connected to an external crystal socket. Also connect two wires about six inches long to the meter jacks; these are routed along the front edge of the chassis and will be attached to the 1 milliampere meter after the front panel is installed.

While you are still working in the final amplifier compartment, remove the 6SS7 rf detector from its socket and install a 1N34A diode between pins 5 and 8; the cathode goes to pin 5. The output from this detector is quite low, but it does give a relative indication of rf output.

The only metal work on the −522 chassis consists of cutting a ⅝ inch hole in the chassis over the old antenna output terminals for mounting a coaxial chassis connector. A type N connector was used by the author because of its superior characteristics at these frequencies, but an SO-239 (type UHF) could probably be substituted with no noticeable difference. A coaxial relay is mounted directly to this output connector through a double male coaxial adapter (type N, UG-57B/U; type UHF, Dow-Key type F-2).

The −150 volt bias supply is constructed as shown in the schematic of **Fig. 4.** The filter components and bleeder resistor are mounted on a piece of phenolic board, 2 inches wide

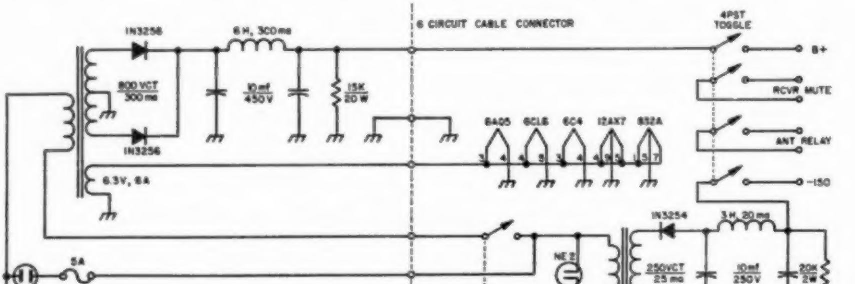

6 CIRCUIT CABLE CONNECTOR
4PST TOGGLE
1N3256
6H, 300ma
800VCT 300ma
10mf 450V
15K 20W
1N3256
6.3V, 6A
B+
RCVR MUTE
6AQ5
6CL6
6C4
12AX7
832A
ANT RELAY
-150
1N3254
3H, 20ma
5A
NE 2
250VCT 25ma
10mf 250V
20K 2W
DPST TOGGLE

Fig. 4. Power supply for the converted SCR-522.

and about 3 inches long. This terminal board and the power transformer are mounted to the chassis with standoffs as shown in the photograph. Although the schematic indicates the use of a small choke, the total current drain of this supply is only 6 mils, so a 2 watt carbon resistor (about 2000 ohms) could be substituted in place of the choke with almost no difference in 60 cycle filtering. In the supply shown in the photographs, the output voltage is just about −150 volts. With different parts, the voltage may differ somewhat and it will be necessary to use a voltage divider on the output to obtain −150 volts.

Two 6 lug terminal strips (H. H. Smith type 3006) are installed in the bottom of the chassis adjacent to the 832A tripler/driver stage and all power and control wiring is brought to these points. This may seem like gilding the lily, but it aids immeasurably in wiring and in any maintenance that might be required at a later date. I might also add that neatness and appearance are considerably improved. All of the power and control circuitry is wired as illustrated in **Fig. 4.**

Basically, the modernized −522 transmitter is controlled by two toggle switches; one for filament and bias supply control, the other for the transmit/receive function. Note that although the wiring for these switches is shown in **Fig. 4,** there is no pilot light shown for the transmit/receive function. This is because the "transmit" pilot light is wired in parallel with the antenna relay and is powered from the same 115 volt source. The filament switch is a standard DPST toggle, but the transmit/receive switch is a 4PDT unit. This latter toggle switch (Arrow-Hart & Hegeman type 82636) is rather expensive but it is still less costly than the SPST toggle switch and 115 volt relay required to do the same job. A rotary switch could be used in this position at a slightly lower cost.

The entire transmitter chassis is mounted on a standard 19 inch aluminum rack panel as laid out in **Fig. 7.** Although a fourteen inch panel is shown here, a smaller panel may be used with only slight sacrifice in usable panel space; it just happens that this panel was available at the time the conversion was made. Three-quarter inch long, ⅜ inch diameter phenolic spacers (H. H. Smith type 2143) are used between the panel and the chassis to provide clearance for the various mounting screws and hardware on the face of the chassis. The four square variable capacitor shafts are disconnected from the ratchet mechanism, cut off at the machined shoulder, and extended through the panel with standard "¼ to ¼" shaft extenders (H. H. Smith type

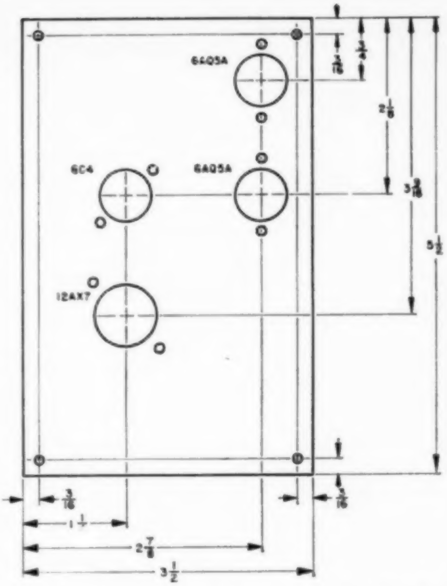
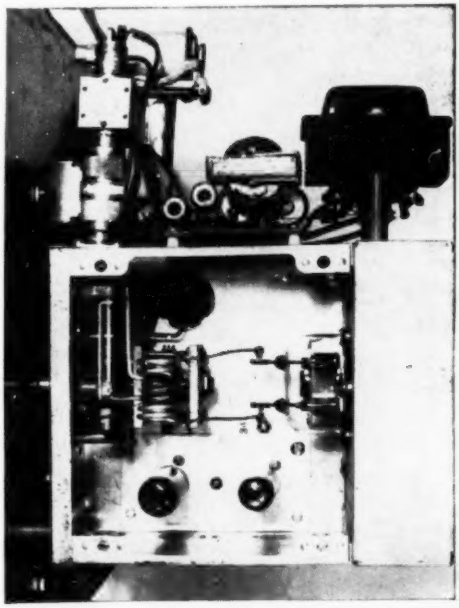


Fig. 5. Mounting plate for new audio circuitry



Final amplifier compartment of the modernized SCR-522. The 6AQ5 oscillator/tripler and 6CL6 tripler are mounted on small plate at the bottom of the compartment. This view also shows the bias supply (upper right) and antenna changeover relay (upper left).

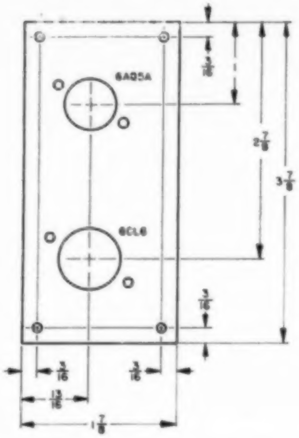

6AQ5A
6CL6
$\frac{3}{16}$
$2\frac{7}{8}$
$3\frac{7}{8}$
$\frac{3}{16}$
$\frac{3}{16}$
$\frac{3}{16}$
$\frac{13}{16}$
$1\frac{7}{8}$

Fig. 6. Aluminum sheet for mounting new rf tubes.

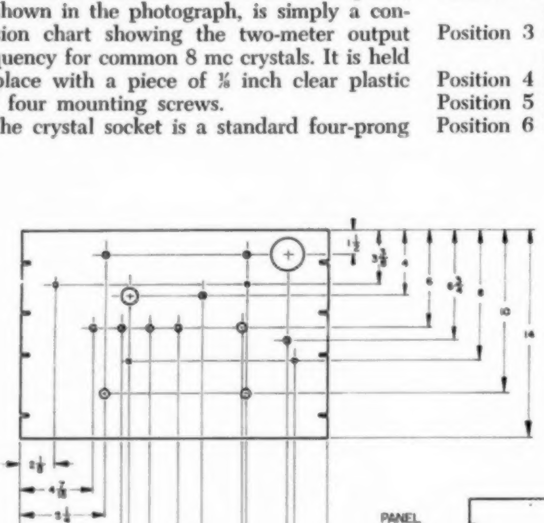
150). A shaft extender is also used with the meter switch, but none is required for the new audio control.

The chart mounted on the face of the panel, as shown in the photograph, is simply a conversion chart showing the two-meter output frequency for common 8 mc crystals. It is held in place with a piece of ⅛ inch clear plastic and four mounting screws.

The crystal socket is a standard four-prong tube socket with two pairs of contacts wired in parallel. This permits the use of different sized surplus 8 mc crystals of the FT-243 and FT-241 series. Another small socket will have to be added (or an adapter made) for the smaller HC-6/U type units. The one milliampere meter and microphone connector are also installed on the front panel and wired into the circuit with the wires provided. When wiring in the microphone connector, make sure you have a good ground connection to the main chassis; a poor ground or bad solder joint at this point will result in all kinds of hard to find regeneration and instability.

The meter switching is not illustrated in the schematic drawings because of the added complexity and the fact that it is not modified in any way. Essentially, the meter circuit consists of switching a one milliampere meter across low resistance shunts which remain in the line all the time. The meter switch positions (moving in a clockwise direction), function, and respective current readings are as follows:

Position 1	6CL6 plate current	40 ma
Position 2	832A tripler/driver plate current	50 ma
Position 3	832A final amplifier plate current	60-70 ma
Position 4	Diode r-f detector output	1-3 ma
Position 5	Final amplifier grid drive	1-2 ma
Position 6	Meter off	–


$1\frac{1}{2}$
$3\frac{3}{8}$
4
6
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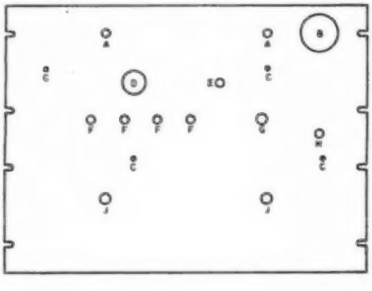
8
10
14
$2\frac{1}{8}$
$4\frac{7}{8}$
$5\frac{1}{4}$
$6\frac{3}{16}$
$6\frac{3}{4}$
$7\frac{13}{16}$
$9\frac{11}{16}$
$11\frac{1}{4}$
$13\frac{3}{16}$
$13\frac{7}{8}$
$16\frac{7}{16}$
$16\frac{13}{16}$
19

HOLE SIZES

- A PILOT LIGHT MOUNTING HOLES. 3/8" DIAMETER.
- B METER CUTOUT. APPROXIMATELY 2" DIAMETER.
- C PRIMARY SCR-522 MOUNTING SCREWS. 5/32" DIAMETER TO PASS 6-32 SCREWS.
- D CRYSTAL SOCKET CUTOUT (4 PRONG TUBE SOCKET). 1-1/8" DIAMETER.
- E METER SWITCH HOLE. 3/8" DIAMETER.
- F TUNING CAPACITOR HOLES. 3/8" DIAMETER.
- G MICROPHONE CONNECTOR. 1/2" DIAMETER.
- H AUDIO GAIN CONTROL MOUNTING HOLE. 3/8"
- J TOGGLE SWITCH MOUNTING HOLES. 1/2" DIAM.

PANEL LAYOUT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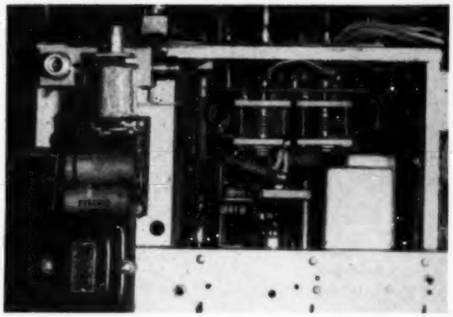

Top view of the transmitter shows the —150 volt bias supply and coaxial relay on the left and butterfly tuning capacitors in the center.

A grid-dip meter or other frequency indicating instrument must be used during the initial tuneup. Since this transmitter was originally designed for operation on any frequency between 100 and 156 mc, its tuning range is quite wide. In addition, the variable butterfly tuning capacitors operate over a 90° range as opposed to the conventional 180°, so some method must be used to ensure that each stage is operating at the correct frequency. As an aid to subsequent tuneups, all of the variable capacitor control knobs are oriented so that they point straight up when the transmitter is ready to go on two meters (see photograph). The stages are initially tuned as follows:

Crystal Oscillator/Doubler	6AQ5A	16 mc
Tripler	6CL6	48 mc
Tripler/Driver	832A	144 mc
Final Amplifier	832A	144 mc

Any high-voltage power supply that provides from 300 to 600 volts at about 235 milliamps and 6.3 volts a-c at 6 amps is suitable for the modernized SCR-522. This may be realized quite easily with an old TV power transformer and silicon diode circuit wired as shown in **Fig. 4.** Occasionally the RA-62B power unit appears on the surplus market at a nominal cost; this unit was designed specifically for the job, but requires the use of 12.6 volt filament tubes.

This transmitter has been used for several months and has provided good performance both as a two-meter transmitter and as a driver for 432 mc gear. The modulation is exceptionally clean and has resulted in many excellent reports. On two-meters, Q5 contacts have been consistently maintained over 75 mile paths using this transmitter and a ground-plane antenna. All in all, it has proven to be a worthy investment for the small amount of time and money involved.

. . . WA6BSO

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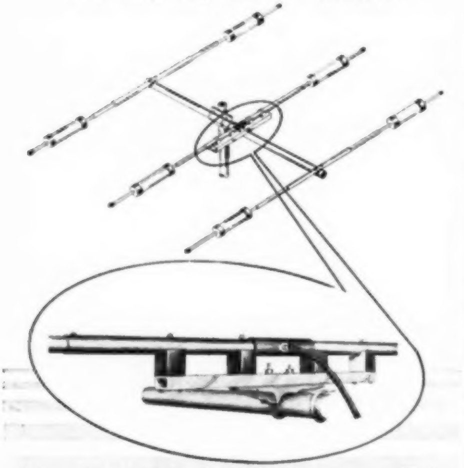

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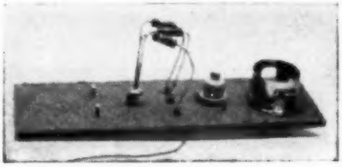


The Ultra-Breadboard

W3ITO's article "PRINTED CIRCUITS—ALMOST" in the March 1965 issue of 73 prodded me into disclosing to the waiting world an intermediate step between the circuit drawn on paper and the finished product as shown in the W3ITO article.

Usually there is a lot of experimental work to be done before the project is finished. The circuit as drawn on paper just doesn't perform as planned and the finished product is found to be full of unused holes and odd locations for some of the parts.

The Ultra-Breadboard was born to fill the need of a cheap method of trying out new ideas and getting final layouts without destroying the usefulness of the parts used.

⅛ inch Masonite Prest-Wood and number 14 bare copper wire are the only materials needed and both are readily available and cheap. Your regular socket hole punches and other tools normally found around the shack are all you will need.

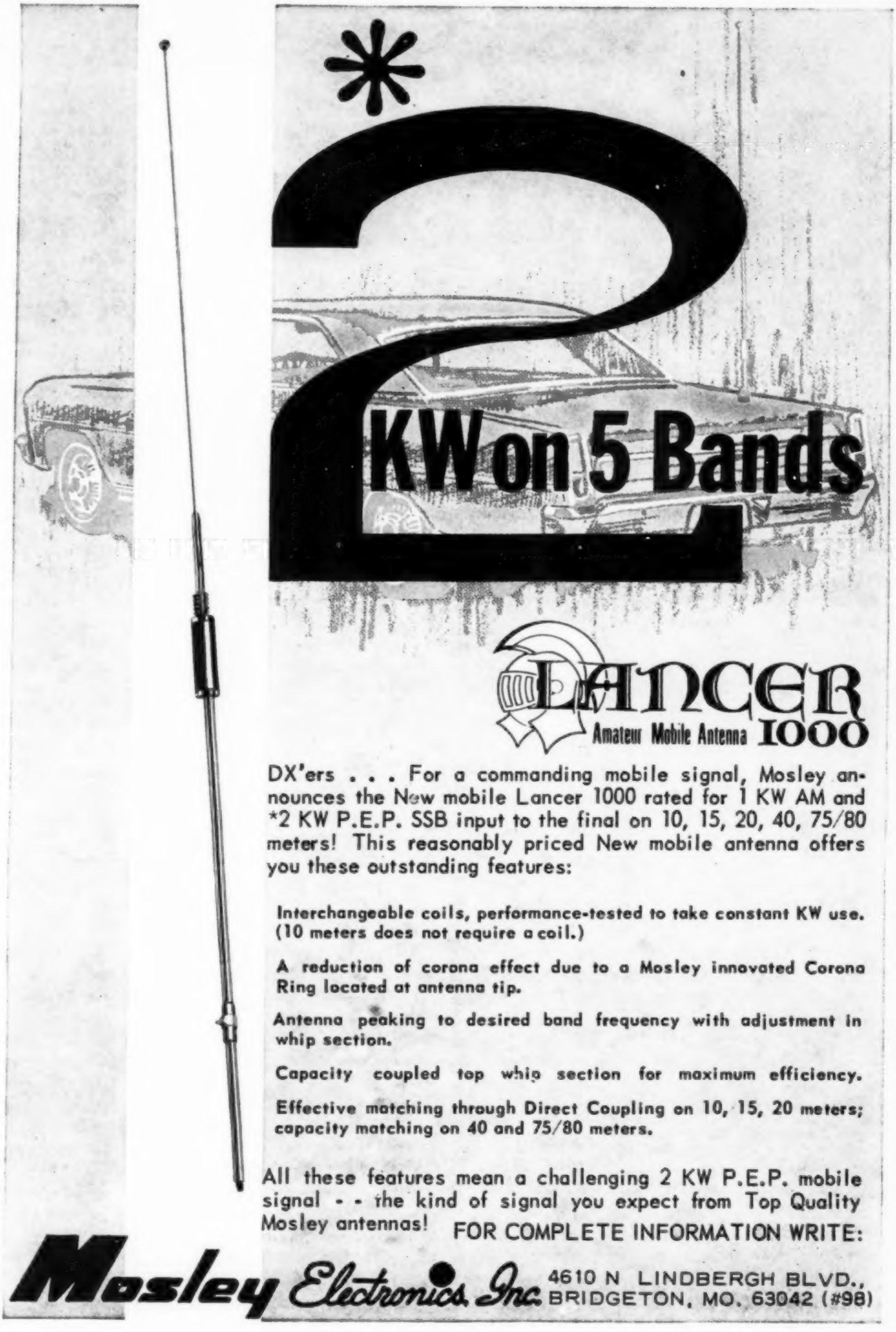
The first step is to draw the *CIRCUIT* you are going to use in the project. Then, using *OUTLINES OF THE PARTS* lay them out on a piece of paper, using dots to indicate tie-points. Transfer the dots to a piece of Prest-Wood and drill with a 1/64 inch drill. Insert short pieces of the #14 wire through the holes. If a small flat is pressed into the wire where it will be imbedded in the Prest-Wood, the wire will be held securely.

Solder the various parts to the tie points and try the thing. If it doesn't work to suit, simply change parts, rearrange things till you get things perking and then go to the layout in W3ITO's article.

It isn't necessary to cut the leads to resistors and condensers unless you are working on UHF or VHF equipment, and the parts can be recovered undamaged to use on the next project.

A small loop on the end of one of the wires permits several parts to be soldered to the same tie point. Another advantage is that since the wires project on both sides of the board, only those parts which are to be experimented with are soldered to the top projections, other wiring is done on the bottom out of the way.

. . . W0PHY L. A. Stapp



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The First and the Last Q-5er

The ubiquitous command sets based on the Type K "channel" design were the most numerous single type of radio gear to come out of World War II, and the low frequency receiver, the "Q-5er" was the longest-lived component of that prolific breed.

That most durable command set covered 190-550 kc in its final design. It was the first to be put on the drawing boards in 1935 and its civilian version was manufactured by Aircraft Radio Corp. into the 1960's, a fantastic life span in a 25 year period of electronic advances which reached from the TRF receiver to satellite computers.

The last military-sponsored set in the Command line was a Navy project, designed in the waning days of the war as a modification of the command receiver. It incorporated modern automatic gain control and diode noise limiting while abandoning the CW oscillator and the outputs for the by-then defunct ZA instrument landing system.

Historically, Aircraft Radio Corp. had come into being in 1928 with a low frequency (200-400 kc) tuned-radio-frequency receiver for the fledgling air lines of that day. The original Radio Frequency Laboratory Model B was bought by the Signal Corps and the Bureau of Aeronautics in a military version which lasted to see action in the disastrous early days of World War II, 13 years later.

The fatal mishaps in the Army Air Mail flights of 1934 set the stage for a new radio type for the Air Corps, the superheterodyne. The Aircraft Radio Corp. "channel" receivers were designed to meet that need in 1935-37, at first for the Army, but finally for the Navy, which saw the value of the design when the Army could not.

The first "Command Set" was a 200-580 kc receiver, painstakingly hand-assembled at A.R.C.'s tiny Boonton, New Jersey, plant. It used double-ended tubes in RF and *if* stages, plus a new tetrode output stage using, during development, three tubes built for A.R.C., the RCA type 1278, the Raytheon CK-45, and the Sylvania S-392. The 1278 was later standardized as the 12A6.

Among advances in the set were small mica button capacitors, assembled of silvered-mica wafers on a stainless steel stud. They had accuracy and stability parameters significantly above the then-industry standard.

Small paper and electrolytic capacitors were designed for bypass and filter functions by A.R.C. and Cornell-Dublier, a nearby New Jersey firm.

Special switches, *if* transformers, chokes and output transformers were hand-built at A.R.C. along with specially-machined hardware and painstakingly formed chassis and other sheet metal components. Riveting was an art perfected by A.R.C. machinist John Johanson for what were, by 1936 standards, extremely miniature components.

Automatic volume control circuits had been worked out by A.R.C. engineers ten years earlier before the Corporation had sold the Radio Frequency Labs trademark and patents. The second hand-built channel receivers contained a wide-range AVC circuit, with front-panel AVC controls.

The new design went to both the Navy, at Bellevue, in Washington, D.C., and to the

Gordon is the Washington correspondent of the Deseret News and KSL in Salt Lake City, and KGMB in Honolulu. He has a BA from Cornell and an MS from Columbia and has written a number of surplus articles and a surplus column for CQ.

Army's Wright Field, Ohio, test facility. The Army did not buy it. The Navy did.

In the confusion of the 1940-41 buildup of U.S. air forces the Type K Command Set (including the familiar Command transmitters and other components) was bought by both the Army and the Navy. It was first made as Navy Type RAT and RAT-1, then, jointly, as SCR-274-N (for Navy), with agreements on specifications which included a rudimentary AVC. This design applied only enough control to the RF and *if* stage grids to prevent "course reversals" through RF overloading when flying the low frequency navigation ranges of the day.

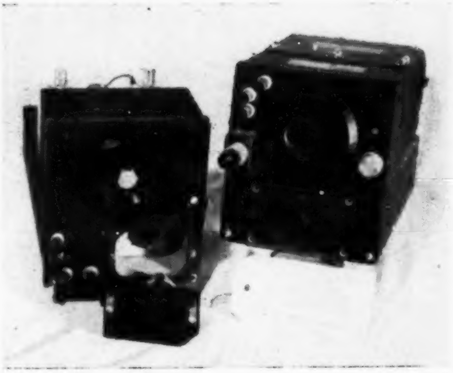
The AVC designed into the second series of Type K reeciver prototypes derived a bias voltage from the same diode detector leak used to furnish audio output, fed back to the control grids of the variable mu (remote cut off) 6K7 RF and *if* tubes. Manual gain control was achieved by grounding the AVC line and varying a resistance in the RF and *if* cathode circuits.

The SCR-274-N and Navy ARA AVC circuit derived bias voltage across a 100,000 ohm resistor, bypassed for audio, in the grid circuit of the last *if* tube. The voltage developed there at high RF levels was applied to the grids of preceding stages. The system preserves the modulation envelope pretty well for subsequent detection. (When the detector diode feeds a delayed AVC line, extraction of power from the *if* circuit by the AVC only at the top of the modulation envelope tends to distort the audio peaks. This drawback was overcome in the latter AN/ARC-5 sets by using undelayed AVC clamped by a shunt diode which provides the required "delay" in the AVC action) "blocking," which the SCR-274-N and ARA sets were designed to defeat would have given spurious navigation information by giving decreased output with increased input beyond a certain RF input level.

The RAT, RAV and ARA designs were virtually identical with the SCR-274-N (N for Navy) production through 1942, but changes were in the wind.

Crystal control had become practical. Stability was of the essence. Command sets were being used for fleet communications over much longer distances than the design basis of short-range plane-to-plane work. Combat pilots could not twist volume control knobs continually. Special instrument landing system equipment was used with teh Command system.

The author has already described the Naval Research Laboratory Crystal-controlled command set—with AVC—circa 1943. Official Naval correspondence reveals the problems which cried desperately for improved gear to handle the new demand of the services. The Army itself sent A.R.C. President Dr. Lewis M. Hull to Europe with General Harold McClelland to see what could be done to improve communications in the Eighth Air Force.



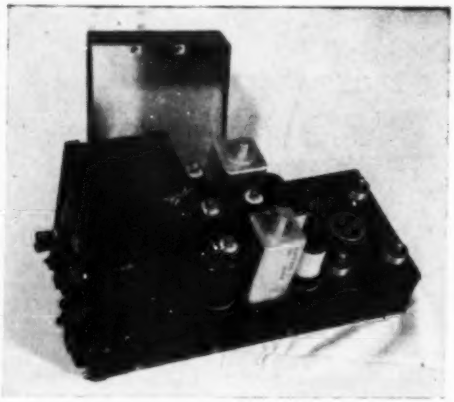
On the left is the Model 1, Serial 1 low frequency Command receiver, circa 1936. Note the slightly different front panel control panel, the phone jacks and different placement of the antenna and ground fittings. The dial was adapted from the Navy RU series receiver.

Dr. Hull's highly-classified recommendations: remove all controls except volume from the pilots' panel; locktune or crystal-control the Command Set, and add AVC to make even the volume control unnecessary.

Back in Boonton A.R.C. engineers attacked both problems. Under a contract calling for receivers to operate with the ZA ILS system, with the assistance of Air Track Corporation engineers, the low frequency command receivers were overhauled. Delayed AVC of a more conventional type was applied to the 190-550 and 520-1,500 kc receivers and cathode follower outputs were provided to the ZA equipment in the aircraft.

The product was the R-20, R-21, R-22, R-23, R-24 receivers. The first three, covering 1.5-9.1 mc retained the SCR-274-N AVC, while the navigation sets were more drastically altered. All five bands were given new, redesigned, temperature-compensated front ends, additional use of ceramic dielectrics, and new external controls. A type 12SF7 *if* tube was specified in order to provide proper bias on the cathode of the AVC stage in the new design, and to avoid interaction between the AVC and the BFO circuits.

Before R-20, R-21 and R-22 production was put into high gear the Navy decided to put full AVC into all the command receivers. The



Top view of the first Q-5er. The set used only two 90 kc if circuits. Designer Paul O. Farnham said recently "the use of three tuned if coupling units on the two lower frequency bands was not deemed proper because two such tuned units appeared to give adequate gain and selectivity. We changed our minds later." Tube lineup in this set included 6K7 RF and if tubes, 6L7 mixer, and 6H6 detector. Audio and BFO tubes were experimental Raytheon CK-45 power pentodes with 6.3 volt heaters designed for A.R.C.

modified sets were labeled R-25, R-26 and R-27 in the AN/ARC-5 series.

The tuning capacitor in the ARC-5 series was a completely new component. It was so built—out of brass and invar (36% nickel) steel, as to have a slight (.000015 pf/pf/degree C.) negative coefficient, i.e., with normal warmup heating it would decrease in capacitance. (An un-compensated capacitor would be expected to increase markedly in capacitance with temperature.)

The warmup of the oscillator tube and the oscillator tank coil would tend to increase the circuit capacitance. The negative tuning capacitor behavior would thus tend to offset that change. Residual changes were absorbed by an additional small (3 pf) "padder" with a negative coefficient of 750 parts per million per degree centigrade.

Unfortunately the R-23 and its sister R-24 (520-1,500 kc) receiver suffered from low audio output problems. Back at the drawing boards the A.R.C. Engineers under designer Dr. Frederick Drake made more changes.

Output with the improved circuit was increased from 120 milliwatts for the standard input of 10 microvolts at 1000 cycles modulated to 30 percent to better than 400 milliwatts.

This new model—the R-23-A/ARC-5—was accepted by the Navy in 1945 despite the fact that the test aircraft at Anacostia Naval Air Station in Washington was equipped with a 14 volt electrical system. (The R-23-A was a 28 volt receiver.) Engineer Norman J. Anderson recalled recently that a planeload of Navy brass found the set highly improved despite the half-voltage on the tube heaters.

Shortly afterwards the Navy ordered the R-148/ARC-5x, a 14 volt model of the R-23-A.

By the end of the war the ZA ILS system had disappeared. The low-frequency command receiver became a standard item on all military aircraft for range nagivation even though the transmitters and receivers for other bands were abandoned and the CW oscillator joined the ZA in disuse.

Although the R-23-A was now standardized, low-frequency navigation was disappearing. By 1960 it was a relic in North America and obsolescent overseas. VHF Omni had replaced it. The R-23-A remained as a little-used standby in transport aircraft, a role it still plays, today, in 1966, thirty years after it was designed.

The final improvement in the receiver was noise-limiting, proposed by the Navy in 1946. The 12SR7 BFO tube and the BFO transformer, plus the ZA output circuits were dropped. In their places were added a 12H6 double diode and a noise-limiter control relay. The 12A6 output tetrode was replaced by a tetrode-diode tube under the RCA experimental number A-5023.

Noise limiting had first been applied to command receivers in the 1944 VHF receiver design, following techniques developed by the British in wartime research. It had been the subject of considerable research in both private and government labs in this country, with detailed work done by Maguire Industries under a Navy contract.

The R-112 and R-112/ARC-5 receivers used diode-connected triode noise limiting circuits, but the R-23-A was built with the 12H6 twin diode tube. AVC in the set was delayed by using the diode in the 12SF7 *if* tube as a clamp to prevent AVC voltage from appearing at the RF and *if* grids until enough AVC voltage had been generated to override the 30 volt cathode bias on the 12SF7 tube.

The modified R-23-A was examined at Wright Field and at NRL in 1945 and 1946. At the same time competitive bidding on R-23-A procurement brought in the Lewyt Corporation and Stromberg Carlson. The former failed to fulfil an 1,100 set contract according to specifications and the latter finally dropped command set production. A.R.C. officials were stung by the postwar military procurement depression and moved into the civilian market. The Command Sets were finally demobilized and dressed in gray peacetime paint.

Engineer Paul O. Farnham, the designer of much of the command gear, told this writer he was disappointed to see the command design changed, the dial discarded, the plug-in RF and *if* feature abandoned, and cost made a higher consideration than maintenance convenience.

But in many ways the postwar gear was very good. The best materials were no longer scarce. New ceramics and modern finishes including better insulating varnish and other top-quality components were now available. Locktal tubes such as the 14A7 and the 14R7 were ready. They eliminated the moisture-holding tube base of octal tubes and offered improvements in reliability.

Early R-11 (civilian) receivers returned to the twin-triode NL circuit, but VHF gear was built with a double triode AVC-NL-detector designed by Farnham, using an unbypassed audio cathode resistance. Later (1958) a highly effective squelch was added to this circuit.

The dial-less, ceramic-insulated locktal-tube command set was basically designed in 1946 by Engineer Norman J. Anderson with only slight changes from the modified R-23-A to adapt the postwar tubes.

The last 15 years of command set production was devoted chiefly to these civilian versions, R-10, R-11, R-13, R-15 and R-19 which were bought in large numbers by the military for use in the Korean conflict in 1950-54. Aircraft Radio Corp. was rescued from the postwar aircraft equipment depression by the demand of the Army and Navy for lightweight radio gear to be used in helicopters and spotting planes like the L-17 Navion, the L-19, and aircraft as large as light twins and jet trainers such as the T-37.

Much of the business went into Cessna-built light planes, an association that culminated in 1957 in the purchase of A.R.C., by the Cessna Corporation. The transaction came at the time that crystal control was becoming mandatory in civil flying and transistors were revolutionizing electronic design.

Most of the old hands at A.R.C. have now left Boonton. President Lewis Hull, Field Engineer Al Parkes, Paul Farnham, Norman Anderson, John Johanson, and the father of the command sets, Dr. Fred Drake were all retired from A.R.C. by 1961 when the last Command receiver left the white clapboard plant in Boonton, N.J. The Command Sets, and an era, had ended.

. . . White

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Reviewed in NEW PRODUCTS page 115 November 1965

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ZL4GA

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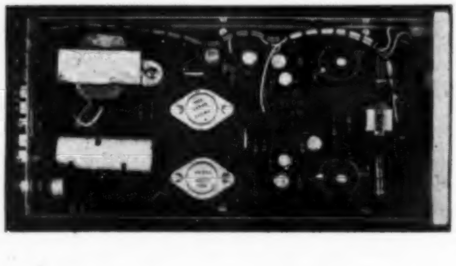
The Stoner RT-1 RTTY Converter

The new Stoner RT-1 radioteletype converter provides a simple and economical way of getting on the local RTTY net. If you have a receiver and a printer, the RT-1 is the only accessory necessary to copy ham RTTY qso's, press stations and other 60 WPM radioteletype transmissions. This is particularly advantageous because with many converters, both commercial and homebrew, a separate bias supply is required to furnish 60 mils of printer magnet current; with the RT-1 the necessary supply is built in.

This converter is very simple to use and if you already have the receiver and printer, it only takes about five minutes to hook up and start copying RTTY signals. All you have to do is connect the converter between the 500 ohm output of the receiver and the printer. In the event your receiver does not have a 500 ohm output, a matching transformer should be inserted in the line. After the RT-1 is properly connected, there is one adjustment that has to be made; this is the adjustment for exactly 60 ma of printer magnet current. This is quickly and easily done with a control mounted on the rear of the converter. This unit is completely transistorized and has a built in meter so an accessory tuning indicator such as an oscilloscope is not required for proper tuning.

The operation of this converter is very straight-forward; the audio signal from the receiver is fed into an impedance matching transformer which steps the 500 ohm line up to 10K to feed the transistor circuitry. The first transistor in the circuit limits and amplifies the audio signal. The amplified tone is taken from the collector and fed to two toroidal filters, one tuned to 2125 Hz (space), the other to 2975 Hz (mark). The tuned circuits are link coupled to the mark and space detectors. The output of these transistorized detectors consists of a square wave which varies in step with the keyed RTTY signal. A meter is inserted into the circuit so that it sums the detector collector currents. When an RTTY signal is properly tuned in, the two currents are approximately equal and the meter reads a steady upward deflection.



The square wave outputs from the class B transistor detectors are used to key a two transistor squaring stage. The output from this squaring circuit is a nearly perfect square wave replica of the original RTTY keying signal. This square wave is the correct shape to drive the printer magnet, but has insufficient current to actuate the armature; therefore it must be run through a d-c amplifier. The necessary amplication is accomplished in a switch driver and the amplified output used to initiate operation of the printer magnet switching transistor. Normally this stage is conducting continuously and the RTTY pulses interrupt the current flow to initiate printing. A transistor current regulator is connected in series with the switching transistor and is set for 60 ma through the printer magnet coil.

Although the Stoner RT-1 converter was designed specifically for 850 Hz frequency shift keying, shifts of other than 850 Hz may be copied by setting it for single channel operation. Simply tune the receiver to where the printer magnet chatters the loudest (with the printer drive motor off). If the copy is still garbled, change the "normal-reverse" switch and retune the receiver. If the copy is still garbled, chances are the RTTY keying information is being transmitted at other than 60 words per minute, the standard for amateur operation.

If you are contemplating RTTY operation, for $99.50 the RT-1 appears to provide a simple and economical approach to the converter problem. It eliminates the bulky printer magnet current supply and being transistorized, it is quite small and light-weight. For more information, write to Stoner Electronics, Alta Loma, California. . . . WA6BSO

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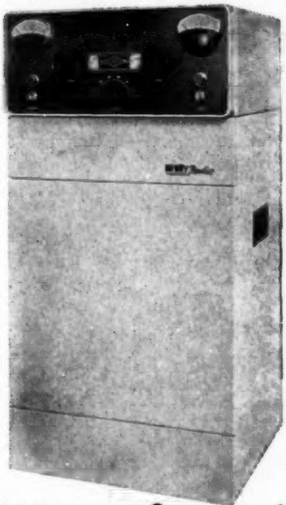

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Five Band VHF Receiver from an RDZ

The conversion of this receiver to a 5 band VHF receiver is a worthwhile project. Although this rig would never be used for a portable or mobile operation, (weight 150 pounds), it is a fine addition to any ham shack. While the first part of this procedure might seem harsh, it is necessary so that the receiver may be utilized for more than one band. First, remove the front panel covering the dial and crystal compartment. Also release handle latches and pull out chassis from the cabinet.

Looking in from the front, on the left you will see the automatic tuning unit and the preselector converter unit. All of this must go, as it won't be used except the first 1F transformer which is on the right rear corner of the converter unit.

These units come out in two seperate pieces, the automatic tuning unit is removed through the front and the converter unit is removed from the bottom. This is done by removing the braces and metal work directly under this unit. This can then be stripped of all parts or a similar chassis can be installed for the next phase. You will notice 3 wires coming in from the power supply. They are AVC, B+, and filament.

Cut these wires off at the chassis as longer wires will be used later. Also, if a new chassis is used, be sure to save the first 1F mounted on the converter unit.

The heavy cable that was fastened to the terminal strip of the automatic tuning unit can be cut off or removed at the inside rear of the cabinet, as the antenna coax wire is inside this cable. You might want to split open the cable and save this as it will be easier than running a new coax from the rear panel.

Now, remove the cover from the power supply and lift B— and run a wire from this point up to the front panel and install a toggle switch directly under the meter adjustment pot.

Next step is to find a Standard Coil tuner from a junked TV set. Most of these sets were manufactured between 1950 and 1960. The make or model doesn't matter as long as it has a Standard Coil tuner. Take the tuner apart by removing the turret and examine all parts especially for burned resistors, broken tube sockets, etc. . . Clean the contacts, and with the turret recoved, find the 1F output coil and remove this from the circuit. This coil went from the oscillator plate to the 1F's of the set.

Now, install a 470 ohm ½ watt resistor from the plate to an 18 inch length of the 72 ohm coax, ground the shield and run through a hole in the back of the tuner, leaving room for the turret to turn. Install longer wires on the tuner, B+, AVC, and filament, and install the turret.

Now, temporarily connect filament leads to the receiver power and using a grid dipper, check out channel 2 coils, and see how far down you will have to move for 6 meters. By padding with small capacitors or by adding a couple of turns of the same diameter wire, you can put it right on the button. This procedure is used on all bands 27, 28, 50, 144, and 220 MHz.

The fine tune control is used to tune the band. In the 10 meter position the fine tuner will cover the band, on 6 meter the first megahertz.

If more range is needed, wind another set of coils and insert in next position of turret. On 2 meters, it will tune about 2 megahertz and so forth. Most of these tuners use a 6BG5 or 6BQ7 tube as the rf amplifier, and either 6J6 or 6U8 mixer and oscillator tubes. The coax from the tuner now goes to the first 1F coil that was previously mentioned to save. The tuner is now mounted on the receiver chassis and a hole is drilled in the front cover for the shaft to protrude.

As these tuners are 300 ohm input a matching transformer from 72 ohm to 300 ohm was used as 72 ohm coax is used at this station to the antenna.

Some of these tuners require 2 B+, voltage, which can be picked up in the RDZ power supply.

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73 Magazine

Peterborough, New Hampshire 03458

By peaking the trimmers on top of the tuner on a weak signal, also adjusting the turret coils inductance, sensitivity will be increased considerably.

The IF frequency of this receiver is 15.1 MHz, so the oscillator coil has to tune the IF above the frefuency, such as 65.1 MHz for 6 meters. A 3 x 5 inch speaker was mounted on the opening in the front panel, and wires run to the terminal board on the right hand side of the receiver. Channel 2 coils were used for 6 meters, channel 7 coils used for 2 meters, and channel 13 coils for 220 MHz.

Rewire any of the other coils for the lover bands. You might want to wind a set of coils for 136 MHz, and listen to our satellites. With a grid dipper and a few parts, you will have a reliable receiver that won't take a back seat to any converter.

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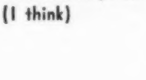

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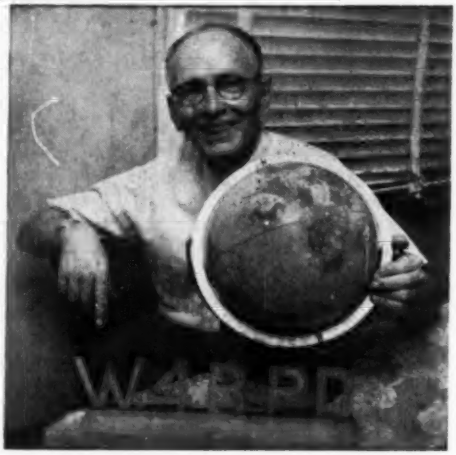

Gus: Part 12

Gus Browning W4BPD

In the last episode my first DXpedition had come to an end. I think I had learned a lot on that trip. I found that I did not mind traveling and really wanted more of it, in fact lots more of it. I had finally got to the point where I did not mind in the least getting tangled up with the customs in the different countries. I had found that I could eat anything that anyone else could with no bad effects. I found that I was not effected with sea sickness at all. Many more things were learned too, such as study the circuit in your rig so that you can troubleshoot anything that went wrong, take a few spare parts and of course spare tubes. Travel light, take your equipment along with you as excess baggage and don't under any circumstances ever let it get into the big custom houses in any country because these fellows at these places can't be made to rush and they have the big custom regulation books to refer to and they will read all the very fine print when you try to take your equipment out of their customs department. If you cannot afford to pay the excess baggage charges on your equipment you had better stay at home, since it does no one any good for you to be in some rare country and not have your equipment along with you to use. I had learned all of this and a few hundred more similar things, and I sure did hope that some day I would get to benefit from what I learned along the way.

When I arrived back home I immediately returned the equipment that had been loaned to me by a fine radio equipment manufacturer. The equipment had held up very nicely with the exception of some filter condensers blowing up on account of extremely high line voltages in a few places and I did have to use a number of the spare tubes. On this first trip I had used only half-wave dipoles, horizontal ones at that, and was hoping someone would come out with a good vertical ground plane, one that could be made up into very small sections and carried in a small canvas bag. I found out that Hy-Gain and their Model 14AVS were the answer to my problem, this model has now been changed to their Model 14-AVQ which is even better then their older 14-AVS and this is the one I have been using ever since. It's very FB from 10 thru 40.

Maybe their new model that goes thru 80 meters would be even better for a DXpedition and save a fellow from a lot of hard work when trying to get up an 80 meter antenna. Possibly they might even make up a sort of DXpedition special with the sections cut up in shorter pieces so it could be carried in a small canvas bag like the Model 14-AVQ I used on my last DXpedition. I admit a three-element beam would be better, but for a one man DXpedition I can just picture the difficulties I would face in trying to get something like this up and down in one piece. You cannot see the difficulties you face when you have about 4 to 10 people trying to help you put up an antenna when they cannot understand a word of English. Then there is the problem of "how will you turn it" when its mounted up in the top of an 80 foot coconut tree and anchored down on "W" land when the Europeans or Australians or South Africans are coming thru. Of course a good rotator would solve that problem. Then there is that other problem of paying all that extra excess baggage if you take the three-element beam and rotor, sometimes there is also the problem of length in some planes and also in every car that you might have to use in moving around in, in some countries. Another thing to consider when using a beam. It's turned on, let's say, W land and maybe at that time is also the best time for the VK boys, and you have the beam on W and you never know that this is the best time also for the VK fellows. In my opinion the only fair answer to the antenna problem is to use a vertical and give everyone a fair chance to work you, admitting that a beam would give your signals maybe one or two more S points. You are rare DX, so let the fellows

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dig a little for you, it sort of makes the chase more interesting if you are a little hard to work. With a vertical no one can say that you have any favorite directions, its up to Ole Man Skip, and out of your hands. With two fellows a beam would be OK, if it can be turned with ease and doesn't happen to stay pointed at your favorite part of the world. For me it's a VERTICAL EVERYTIME.

Well here I was back home from my first DXpedition and everyone asking me "when the next one, Gus?" My answer was always, I have the time but I don't have the money. This usually stopped most of them. But there was a few who said raising money was no problem at all, most of these never did go any further. Buck W4TO was interested in another DXpedition since he had handled the QSL cards for the first trip. I visited him over in Atlanta a few times, and after seeing what a busy fellow Buck was with all of his irons in the fire I came to the conclusion that Buck just could not spare the necessary time to get things underway again. About this time I received a telephone call from Ack W4ECI saying he was interested in taking up the chores involved in a DXpedition of major proportions. We spent many many hours with each other with quite a number of trips to Birmingham thrown in. This trip we wanted to be the real thing, we did not want any stumbling blocks in our way and we wanted this to be a smooth operation all the way. I had met any number of fellows who were interested in helping on a new DXpedition in many different ways. A number of fellows furnished me with some AM phone rigs and others furnished me with small power plants to sort of open the doors to the islands in the Indian Ocean area. Others furnished items that were badly needed by the fellows up in the Himalaya kingdoms, there were many people to write letters to so they would be ready for me when I arrived in their part of the world. I suppose all together 25 or more fellows helped me in many different ways and it was a very fine feeling to know that so many of the fellows were behind me on that trip. I don't think there will ever be such a trip that began with the boys sticking with me and Ack as good as that one. Everything went so smoothly all during the trip, thanks to all the planning by everyone. Even after the trip had been finished I never have heard any real complaints from anyone for being apparently deliberately not worked like sometimes they seem to be on some DXpeditions. My motto was work everyone heard, regardless of who they were or where they were located. This is even now still my motto and it will never change. I have been on the DX from both ends for quite a number of years now and I know how the boys back here are sweating it out and how easy it is for them to misunderstand instructions given over the air with the QRM like it is most of the time.

I was advised by many fellows to put off any further plans for any DXpeditions until the Sun spot situation improved, possibly they were right. But my viewpoint was why wait until later on when all the boys were so eager for the DXpedition to take place now. My policy has always been to strike when the iron was hot, and right then it was about as hot as it would ever be. I looked back in my log books at the last sunspot minimum and by looking at the log I would never have known there was a minimum if I was trying to find it by looking at my logs. Considering the number of QSO's I had during the trip I don't think there would have been many more if the sun spots were at their peak. Of course they certainly did affect the 15 and 10 meter contacts and 20 was open for shorter periods of time. But you know a fellow has to sleep sometimes and with the bands closing somewhat earlier than they would have been with a good sunspot count I did at least get a chance to sleep sometime. But both Ack and I thought it was worth a try and we continued our plans regardless of the mood of the sun.

When Ack and I sent out some copies of our plans as to where we were planning on operating from I heard many remarks over the air from some of the boys such as: "Gus and Ack are dreaming," "this DXpedition will end in less than 3 months," "who do they think they are fooling," "this is a big joke," etc., etc. Well I think Ack and I fooled these fellows. Do you think I made a list of some of the stations making these remarks that I heard over the air? I certainly did not, but it would have made up a dandy little black list I guess. I am certain I left home on the trip I did not think it would ever be completed 100% as it was planned from the beginning. We were both very much surprised that it was concluded as well as it was. I did operate from many places I thought I would never operate from and I will admit I missed a few I thought I would get to. Things don't ever work out exactly like they were planned, at least not with me. When you leave the U.S.A. your plans have to be changed all the time. That is the way things are in the world and I suppose that's the way they will always be.

But it does make things a little bit more interesting I suppose. A surprise here and there makes life interesting I guess.

Wouldn't it be great to go on a DXpedition some day with no plans whatsoever as to where you are going? Maybe one of these days there will be some Sugar-Daddy who will hand me an airline credit card, and a few handfuls of American Express money orders with instructions to just go where you want to go and operate as long as there is pile ups, and then go to some other spot and do the same and to just keep going as long as you like. Boy that would be the DXpeditioners Dream, wouldn't it?

Everything was going along fine with the plans and there was lots to do before I left the USA. Two full days were spent in Washington, D.C., getting visas for the countries I wanted to go to. Then there were all the health shots. Some of the vaccine could not be obtained here in Orangeburg, S.C., and had to be ordered from a larger city. I have forgotten the exact number of shots I had to take, but I felt like a porcupine for about three weeks. In the end I think all these shots did me a lot of good and probably prevented me from picking up a lot of bugs here and there. I am sure something or someone protected me from all the bugs I was exposed to in all the different places I have visited. Something also protected me from stomach disorders I am sure because it was my rule to eat whatever was served me. I used to sort of worry about drinking water, but to this day I have never boiled any before I drank it. On my last trip I did have some of those little pills to put in drinking water to purify it, I think I used maybe one dozen of these pills on the entire trip. I usually gave them to some of the natives to use, explaining what they were supposed to do. I have found that any kind of medicine is always very welcome in almost any country in the world and is usually a good item to use to sort of get them to open their doors to you.

If when you go to Washington, D.C. to get your visas and if you have plenty of time to spend up there you can usually get a good letter of introduction from them (an ambassador's letter is the best) to their Minister of Communications. If you can just once get to see the Minister of Communications in a country and if you say the right things to him and can convince him that you are trying to help their communications you are then in, because he is the man who eventually will make the decision as to whether you operate there or not. A lot of red tape can be saved by seeing the minister himself first. He in turn will usually call one of his head men and let him take over. If the minister says, "go," you are all set and no one can upset your applecart. If I ever go on another DXpedition I want to spend maybe two full weeks in Washington visiting the ambassadors of the countries I want to operate from, with a good letter of introduction from a few U.S. Senators to him and if you are going to Moslem countries, a letter from your church minister if you are a Protestant or Catholic. If you are Jewish stay where you are . . . A letter telling that you are a good, upright citizen from your chief of police helps a little also. Be sure it's written on the Police Department's stationery. If possible have a few Zippo lighters to pass out or if you are well fixed pass out a Parker 51 here and there. I have yet to see the opening where a direct bribe would have done the job, with one exception, and this one wanted $1,000 to open the door and we still have about 4,000 or 5,000 QSL cards for that proposed stop—We counted our chickens before the eggs were hatched.

As a final send off Ack and I were at the Side Band Dinner in New York City and after that it was out to Idlewild airport and on the way to just about the best DXpedition I think there ever will be. We had to buy in New York at the last minute a new power plant because we found out that all the equipment etc. we had shipped many months before were held up somewhere along the way to the Seychelles on account of a strike. This meant much more expenses in air freight. The power plant was shipped to Bombay, to be transhipped on to the Seychelles on the same boat I was going on. ADVICE to the DXpeditioner, be prepared for unexpected financial burdens, because they are always turning up when least expected. I suggest you figure what your trip will cost, taking everything you can think of under consideration and then add about 50% to your figures and you MIGHT come out OK (if you are very careful, that is).

As a sort of warm up practice run and to let the boys know I was on my way I stopped in Monaco for a few days operation after a very short trip around portions of Europe. To the Hotel La Seicle in Monaco I went and as usual checked into the room they seem to hold for DXpeditioners (room #40), up went my antennas and the DXpedition was officially underway. This time I was a little bit better prepared and instead of the KWM-2 and the outboard VFO I had the "S" Line but only barefoot. As usual the very first night at about 2 AM, just like before the filter condensers in the PM-2 power pack blew up on account of that high line voltage, but this time I had brought some 600 volt filters along with me, after substituting these for the 450 volt jobs in the power pack my filter condenser troubles were eliminated for the balance of the trip.

Also I found that the power transformers get awful hot, and I would further recommend that you drill a great many holes all around it and bring along a good electric fan to make it run cooler. Everyone tells me these transformers are made to take a lot of heat—but I like for them to at least be cool enough to put your hand on them without getting burned. A little breeze from the same fan around the final tubes certainly would not do any harm either. I am not much afraid of the heat from the tubes hurting them as I am from the heat doing damage to some of the other components. I think most of the ham transmitters on the market today are FB if they are used, lets say, for a few hours every day, but I don't think they are made to stand, say, 18 to 20 hours duty at a time, especially if the line voltage is on the high side and the cycles are 50 instead of 60 like we have here in the USA. It's 50 cycles practically everywhere. If your travel expense can stand a little extra weight I highly recommend that you take with you a Powerstat that will operate from both 240 and 120 volts, with a built in voltmeter and a knob that's real handy to regulate the voltage. Let the equipment operate on 120 volts but have your Powerstat so that it can be changed from 120 to 240 volts easily without a soldering iron. Your little soldering iron can be a 120 volt one since you will have 120 available at all times by using the Powerstat. Remember you just cannot find 3-way plugs overseas, not of the type we use over here, so bring along a few of these, you can use them in all of your connections EXCEPT the connections to the power source. These oversea plugs can be of almost any size or shape and it's practically impossible to have along with you a universal plug to fit them all. They can usually be bought overseas quite easily though, I myself have found that one set of your Powerstat wires should end up with a pair of Alligator clips on them, these clipped on a piece of solder can be made to fit almost anything you run into. Don't overload yourself with a big box of spare parts, because even then nine out of ten times you will still not have what you need in case you really get into serious rig trouble. . . . Gus

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	301-F	144-146	28-30
	301-Q	144-148	14-18
	301-R	144-148	7-11
	301-S	143.5-148.5	30-35
6M	301-B1	50-51	.6-1.6
	301-B2	51-52	.6-1.6
	301-C1	50-54	7-11
	301-C2	50-54	14-18
	301-J	50-52	28-30
20M	301-G	13.6-14.6	.6-1.6
CB	301-A1	26.5-27.5	.6-1.6
	301-A2	26.8-27.3	3.5-4.0
40M	301-K	7-8	.6-1.6
CHU	301-L	3.35	1.0
WWV	301-H	5.0	1.0
Int'l. Marine	301-I1	9-10	.6-1.6
	301-I2	15-16	.6-1.6
	301-M	2-3	.6-1.6
Aircraft	301-N1	118-119	.6-1.6
	301-N2	119-120	.6-1.6
	301-N3	120-121	.6-1.6
	301-N4	121-122	.6-1.6
	301-N5	122-123	.6-1.6
	301-N6	123-124	.6-1.6
Fire, Police etc.	301-P1	154-155	.6-1.6
	301-P2	155-156	.6-1.6
	301-P3	154-158	7-11
	301-P4	154-158	104-108
Weather	301-W1	162.55	1.0
	301-W2	162.55	10.7
	301-W3	162.55	107.0

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Hollis, N.Y. 11423

Paul Franson WA1CCH
Peterborough, N.H.

Guide to Surplus Conversions

Many articles have been written—and published—about surplus. These articles have ranged from simple suggestions to complete and detailed conversions such as the one by WA6BSO in this issue of 73. But these conversions are often hard to find; this is well demonstrated by the many articles on surplus that are duplications of other articles.

But it's not really that hard to find surplus conversions. Roy Pafenberg W4WKM has compiled a list of all the conversions he could find in the popular electronics magazines since World War II in the *Index to Surplus* available from many distributors or 73 for $1.50. But the *Index* does not list the articles that have appeared in the various surplus *handbooks* that have been published. That's what this article is for. I've listed the pieces of equipment covered in the six surplus radio handbooks now available. The conversions differ greatly in completeness, so it's suggested that you take a look at any books of interest before you make big plans.

Editors and Engineers

Editors and Engineers, P.O. Box 68003, New Augusta, Indiana, have published three *Surplus Radio Conversion Manuals* by Evenson and Beach and the *Surplus Handbook, Vol. I* by W6NJV and W6NJE. Each costs $3. Here are the pieces of equipment covered in each manual:

Surplus Radio Conversion Manual, Vol. I. BC-221, BC-342, BC-312, BC-348, BC-412, BC-645, BC-646, SCR-274 (BC-453A and BC-457A series), SCR-522, TBY, PE-103A, BC-1068A/1161A.

Surplus Radio Conversion Manual, Vol. II. BC-454, AN/APS-13, BC-457, ARC-5, GO-9/TBW, BC-946B, BC-375, LM, TA-12B, AN/ART-13, AVT-112A, AM-26/AIC, ARB.

Surplus Radio Conversion Manual, Vol. III. APN-1, APN-4, ARC-4, ARC-5, ART-13, BC-191, BC-312, BC-342, BC-348, BC-375, BC-442, BC-453, BC-455, BC-456-9, BC-603, BC-624, BC-696, BC-1066, BC-1253, CBY-5200, COL-43065, CRC-7, DM-34, DY-2, DY-8, FT-241A, MD-7/ARC-5, R-9/APN-4, R-28/ARC-5, RM-52-53, RT-19/ARC-4, RT-159, SCR-274N, SCR-508, SCR-522, SCR-528, SCR-538, T-15 to T-23/ARC-5, URC-4, WE701A.

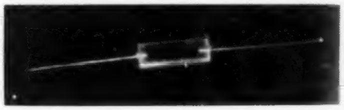
Surplus Handbook, Vol I. This book, subtitled, *Receivers and Transceivers*, is composed of schematics and pictures of the following gear. It doesn't give conversions. APN-1, APS-13, ARB, ARC-4, LF and VHF ARC-5, ARN-5, ARR-2, ASB-7, BC-222, BC-312, BC-314, BC-342, BC-344, BC-348, BC-603, BC-611, BC-624 (SCR-522), BC-652, BC-654, BC-659, BC-669, BC-683, BC-728, BC-745, BC-764, BC-779, BC-794, BC-923, BC-1000, BC-1004, BC-1066, BC-1206, BC-1306, BC-1335, BC-AR-231, CRC-7, DAK-3, GF-11, Mark II, MN-26, RAK-5, RAX, RAL-5, Super Pro, TBY, TCS, VT tube cross index.

CQ Handbooks

CQ has two handbooks on surplus out. They can be ordered from CQ, 14 Vanderventer Avenue, Port Washington, N.Y. The first book, the *Surplus Schematics Handbook*, by Ken Grayson W2HDM, costs $2.50, and contains schematics and short comments about this gear: APA-38, APN-1, APR-1, APR-2, APS-13, ARB, ARC-1, ARC-3, ARC-4, ARC-5, ARC-5 VHF, ARJ-ARK-ATJ, ARN-7, ARR-2, ART-13, ASB, AS-81-GR, ATK, BC-AR-231, BC-189, BC-191, BC-221, BC-312, BC-314, BC-342, BC-344, BC-348, BC-375, BC-438, BC-474A, BC-603, BC-610, BC-611, BC-620, BC-640, BC-645, BC-652, BC-653, BC-659, BC-683, BC-684, BC-728, BC-733, BC-745, BC-779, BC-794, BC-906, BC-969, BC-1000, BC-1004, BC-1023, BC-1206, BC-1335, BN, BP, C3, CRC-7, CRO-208, CRT-3, DAE, F3, GF-11, GO-9, GRR-5, I-122, I-177, I-208, JT-350A, LM, Mark II, MD-7, MN-26, PRC-6, PRS-3, R-174, RAK, RAL, RAO-7, RAS, RAX, RBH, RBL, RBM, RBS, RC-56, RC-57, RDC, RDR, RDZ, RU-16, SCR-274, SCR-284, SCR-288, SCR-300, SCR-506, SCR-522, SCR-578, SCR-585, SCR-593, SCR-608, SCR-610, SCR-624, SCR-628, SPR-1, SPR-2, TBS, TBW, TBX, TBY, TCK, TCS, TG-34, TS-34/AP, TS-251/UP, VRC, VVX-1.

The other CQ book, the *Surplus Conversion Handbook* by Tom Kneitel K3FLL, ($3) contains conversion on these pieces of gear: ARC-1, ARC-3 , ARC-4, ARC-5, ARC-36, ARC-49, ART-13, ATA, ATC-1, BC-191F, BC-224, BC-312, BC-314, BC-343, BC-344, BC-348, BC-375E, BC-453, BC-454, BC-455, BC-457A, BC-458A, BC-459A, BC-603, BC-604, BC-620, BC-624A, BC-625A, BC-659, BC-669, BC-683, BC-684, BC-696A, BC-779, BC-794, BC-946, BC-1004, BC-1068A, CBY-52232, PE-73, PE-103, R-129/U, RAX-1, SCR-177, SCR-188, SCR-193, SCR-274N, SCR-399, SCR-499, SCR-508, SCR-509, SCR-510, SCR-522, SCR-528, SCR-542, SCR-608, SCR-609, SCR-628.

. . . WA1CCH



Cheap Coil or Choke Forms

Not liking to pay the price for Z-144's, I consulted the May '62 issue of 73, page 99, to obtain data for a 2 meter choke coil. The form size specified was 5/16 inch, not a standard size around my shack. The cost of commercial forms of this size was out of the question (when you're as Scotch as I am). Next step: take a 5/16 inch diameter polystyrene rod and cut a section to required length for winding the choke.

To make the form, prepare polystyrene rod as shown in the photo. Then hold section of polystyrene rod in vise or some other secure manner. Now take lengths of #18 or #20 wire, depending on strength desired in the leads. Place length of wire against end of polystyrene rod in center, carefully apply enough heat with soldering iron to cause the wire to penetrate deep enough into the polystyrene rod for good mechanical strength, then remove heat and let set. Repeat for other end.

After both lengths of wire are firmly set, wind desired choke. Care should be exercised in soldering coil wire to wire leads. A heat sink is recommended to avoid excessive movement of leads.

This inexpensive method of making rf chokes is used quite successfully at my QTH.

. . . Gary Smith WA0ASA

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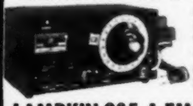

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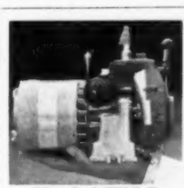

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NEWS FROM THE INSTITUTE OF AMATEUR RADIO

Compiled by A. David Middelton W7ZC, Secretary

IOAR emphasis now and for the future

The following material has been carefully documented—in depth, to include the aims, goals and purposes of the Institute. Many of these are goals to be reached in the future when sufficient membership, support and money are available. Many projects are currently active and more are being implemented.

The Institute intends to emphasize individual effort along technological lines and point up self-incentiveness and achievement of the individual operator.

The Institute will recognize and award appropriate citations to group activities that are deemed above and beyond those normally found in amateur radio circles.

Those activities that have been recognized and rewarded (by various certificates etc.) by other organizations are not to be ignored or overlooked. However, the IoAR will seek out the unusual, the hitherto un-noticed activities in many areas to bring such performances to the attention of the entire amateur body and to the public whenever possible.

The Institute is cognizant of the inevitable—the fact that international conferences, within the next few years, will likely bring radical and disasterous changes in our operation thru the reduction, sharing or even the demise of our currently available lower frequency bands.

The IoAR holds the opinion that amateur radio will survive such a catastrophe, although *AR as we know it now may pass from the scene.*

Therefore, the IoAR will emphasize a completely NEW concept of amateur radio, in which VHF and UHF, through the use of direct, relays or satellite QSOs will expand our horizon and permit AR operation on a scale even greater than now realized!

Amateur radio survived ignominious relagation to "below 200 meters". AR survived segregation into "bands" . AR survived when all foreign and domestic operation was dumped into what were then very narrow bands (considering the expansive areas previously available). AR survived the BCI and the TVI wars that threatened our very existence. (Note—The TVI war is not over yet and now an even greater danger looms—the zoning—deed—restrictions on towers and antennas that are *increasing!*)

AR, so far, has even survived the so-called "appliance-type" operation by turning some of these "appliances" into useful instruments of service to the non-amateur public in emergency, priority, and routine networks of various styles and degrees of value. Mobile operation has been a boon!

Amateur radio, the Institute believes, may survive the drastic changes that will be brought about by international conferences. The IoAR believes that AR will *only* survive (after the roof falls in on our so-called DX bands) by our thorough knowledge and utilization of the VHF and UHF we now have (and which are likely to hold onto) those expansive frequencies above 144 MHz.

This implies knowledge and utilization of techniques with high-performance stations, with relay and satellite assists. It also implies more do-it-yourself technical hamming and more know how!

If the amateurs (and the commercial manufacturers) keep up with these trends and provide equipment suitable for such applications, AR will be greater than ever.

IoAR believes that VHF provides an excellent place for the new amateur, if he is willing to study, read, learn technique, and to observe what others have and are doing.

Amateur radio can survive! There is plenty to intrigue even the most blasé, if he will learn how to use AR, and learn the *technical* as well as the operational side. It is more fun to KNOW than to belittle your own ability by the "NOT KNOW" attitude so prevalent today!

FCC expands intent of 97.125

FCC Regulation 97.125 states—"*Interference:* No licensed radio operator shall willfully or maliciously interfere with or cause interference to any radio communication or signal."

On Feb. 4, 1966, the FCC issued their expanded interpretation of 97.125, as follows:

"This letter will advise you of the Commission's rules and policies applicable to general interference between stations licensed to operate in the amateur radio service.

"As you are undoubtedly aware, frequencies allocated to the amateur radio service must be shared by all licensees. Consequently, interference between stations is most likely to occur during periods of heavy activity on, and occupancy of, an amateur frequency band. Experienced amateur operators are expected to anticipate and minimize this interference. Their failure to do so indicates either ignorance of the practical realities of amateur communications or a selfish lack of consideration for others. Assuming that it is your desire to alleviate interference between amateur stations, the following guidelines and considerations are presented.

"Licensees of stations which are already in op-

IoAR—Totally Dedicated to the Betterment and Preservation of Amateur Radio.

eration should remember that no amateur licensees, group, or network has a right to the priority or exclusive use of a given frequency nor may freedom from interference be expected (exception is provided under the emergency provisions of rule Section 97.107). In addition, common courtesy, as well as good amateur practice, dictate that incessant or continuous non-emergency operation so as to preclude others from operating is highly undesirable and unwarranted and, if willful or malicious, could result in the imposition of punitive measures.

"Licensees of stations who are attempting to utilize an occupied frequency should note that Section 97.125 of the rules provides that: No licensed radio operator shall willfully or maliciously interfere with or cause interference to any radio communication or signal." Moreover, observance of good amateur practice requires the avoidance of attempting operation on a frequency where it is obvious or likely that such operation will result in harmful interference.

"All licensees should avoid the following frequently observed improper practices, some of which constitute willful interference for which severe penalty is provided:

"A. Knowing and repeated operation on, or unreasonably close to, a net frequency at times when the net is obviously active;

B. Requesting or demanding protection of a net frequency at times when the net is inactive;

C. Requesting or demanding protection of a net frequency over a long period of time in the absence of an emergency situation;

D. Calling, testing or tuning on a frequency without first determining that the frequency is not already being used;

E. Carrying on an exchange of communications on two (or more) separate frequencies when there is no technical or operational necessity for such muti-frequency usuage.

"As noted, the foregoing is furnished for your guidance. From long experience, the Commission has found that in most instances neither party to an incident of alleged deliberate interference in the use of frequencies is entirely blameless. The keynote to resolution of these interference problems, therefore, is cooperation and consideration by all persons involved.

"You are permitted and encouraged to read and discuss this letter via your amateur station. You may be assured that any effort on your part to contribute to better amateur radio practices and operations will be greatly appreciated.

"Very truly yours,
S/ Ben F. Waple
Secretary"

Attention—young IOAR members

In keeping with IoAR's program for advancement in amateur radio through individual achievement IoAR emphasizes a building-writing contest—open *only* to IoAR members whose birthdate falls after July 15, 1946.

Important IoAR Addresses

For all correspondence except that regarding membership and supplies:
Institute of Amateur Radio
Springdale, Utah 84767

For membership correspondence and IoAR supplies:
Institute of Amateur Radio
Peterborough, N.H. 03458

First Prize—a $25 Savings Bond, and publication at space rates in 73, for the best construction article for an original piece of AR equipment having at least *five* tubes or transistors.

Second Prize—a $15 Gift certificate, (good toward the purchase of any 73-advertised merchandise) and publication at space rates in 73 for the best construction-article on an original piece of AR equipment having at least *three* tubes or transistors.

Third Prize—a $10 Gift certificate and publication at space rates in 73, for the best construction article on an original piece of AR equipment having less than three tubes or transistors.

All design, construction, photographs and text material must describe only original equipment. Entries must not be copied from articles or equipment in any magazine or handbook. Kit construction or modifications, in any form, are not eligible.

All material submitted will be considered by competent IoAR selected judges. Their decision will be final. Certification of contestant's birthdate may be required by the judges. IoAR membership will be checked by the IoAR membership dept. No correspondence will be conducted by IoAR HQ regarding this contest.

Non-winning entries will be returned only if accompanied by adequate first class postage.

To be eligible for this contest, entries must be received not later than July 15, 1966, at IoAR HQ.

IoAR "Who, What and Why"

The Institue's new 16-page informative booklet is now available!

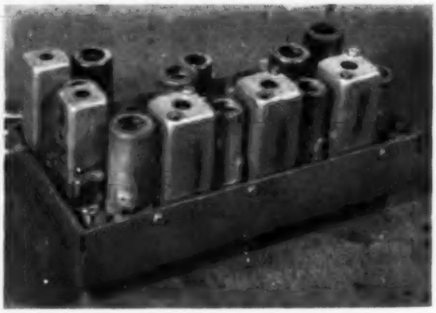
There have been many requests for a comprehensive booklet covering the aims, goals and projects of the IoAR.

Although prepared for study by non-members it also provides a useful "tool in a member's hands when asked—who, what or why is IoAR?

If you would like a copy or copies (in limited quantities) please advise IoAR HQ giving your complete mail address, and accompany your request with an unused 5¢ USA stamp for *each* copy requested.

Lost IoAR members—QTH?

Mishou, Edward C WA5DRU
Coldsby, Edward DL4UC
Shepard, Richard WA0JRE
Please send updated QTH to IoAR HQ.



The ARC-27 guard receiver.

A schematic of the ARC-27 is available from 73 for 50¢

Joseph Hinkelman K3CES
4708 Hillside Rd.
Harrisburg, Pa. 17109

220 mc Receiver from the ARC-27

With the appearance of the ARC-27 on the surplus market more articles are being written every week, about this versatile piece of equipment. The RT-178/ARC-27 is composed of ten different subassemblies all are the plug in type.

The one we are interested in is the Guard Receiver sub-assembly. Each unit is marked making identification easy. The Guard Channel Receiver is a dual conversion superheterodyne receiver with a 19.4 mc first if, and a 3.45 mc second if. The guard channel receiver also incorporates a separate detector, noise limiter and avc section has its own squelch circuit, sensitivity control and audio gain control. The receiver is crystal controlled making it useful for net and MARS operations. The original frequency of the receiver was from 238 mc to 248 mc. A few simple modifications will bring it down to 220 mc to 230 mc.

Modification of unit

Step one will require converting the filaments to 6.3 volt operation. **Fig. 1** shows the original series-parallel circuit that was used with this equipment. Pins 13-10-8 of J-810 will be tied together to the 6.3 v. input. The existing wires may be used by carefully cutting the wires and rerouting it to the necessary socket pins.

Step two in the RF section will be very simple. Coils L-803, L-804 and L-802 can be brought down to 220 mc, simply by squeezing them together. They are marked on the subassembly. A grid dip meter should be used to bring the coils within the proper range.

Step three will require the modification of the First Injection Oscillator. It is this stage that will determine your operating frequency. Xtal Y-801 will have to be changed to whatever frequency in the 220 mc band you wish to operate in. A 33.44 mc xtal will give you a operating frequency of 220.04 mc. The following formula will help in selecting the proper operating xtal

$$\frac{\text{operating freq. desired in mc } 19.4-}{6}$$

$= \text{input xtal freq.}$

You may have to add small capacitors across each coil to bring them down to the proper frequency.

Pin connections to J-810 are as follows: 5 is the sensitivity control lead. Use a 5000 ohm pot to ground. 15 is ground. 3, 4, 7, 9, and 14 are not connected to anything. 1 is −80 volts bias. 6 is +225 volts. 2 is for squelch, use a 25 k pot in parallel to .1 µf capacitor for it. 11 is audio output. The filament connections are shown in Fig. 1.

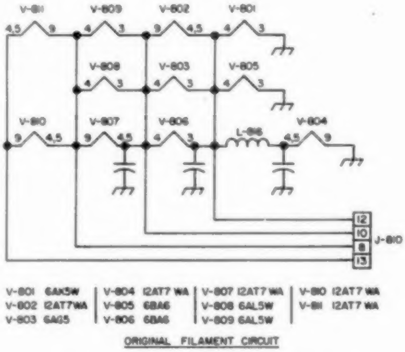


Fig. 1. Original filament circuit.

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PATENT PENDING

The builder may use whatever he may have available in power supplies. The B+ should be 225 volts at 100 ma, and a bias voltage of −80 volts is needed. The filaments will require 6.3 volts at 3 amps.

Tuning and operation

After the RF stages and first injection oscillator have been tuned to their approximate frequency, power should then be turned on. After a smoke test the oscillator should be checked to see that oscillation is taking place. A GDO can be used for this operation or a sensitive wave meter by close coupling to the oscillator tube (V-807). After the oscillator section is working properly a signal generator should be used to peak up the RF section. If no signal generator is available couple an antenna to J-801 and starting with C-811 cap. peak up on the noise then proceed to C-810 doing the same. Last the antenna section should be peaked with variable cap. C-803.

If speaker operation is desired an additional stage of audio will be needed which can be built into the power supply. The author has experienced no difficulty with this unit. Signal results are very good, and with xtal operation no drift was noticeable.

. . . K3CES

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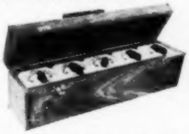

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THE HUSTLER® NEWS

FROM "The home of the originals" *Number 3 in a series*

Springtime is mobile "check-up" time . . .

Below is a check list to evaluate your Amateur mobile antenna installation. Circle number under each of the 5 categories which best describes your installation. Total these numbers and subtract the sum from 100. The balance remaining is your rating. Scores are listed below.

This check list may also be used for new installations. Install your mobile antenna according to the lowest numbers and you'll get the best performance from your equipment.

1. ANTENNA LOCATION

Center of roof	0
Center of rear deck	1
Left rear top of fender	2
Right rear top of fender	3
Left rear side of fender	4
Right rear side of fender	5
Left front cowl or fender	6
Right front cowl or fender	7
Bumper mount—left rear	8
Bumper mount—right rear	9
Bumper mount—left front	10
Bumper mount—right front	11

2. FEEDLINE BASE TERMINATION

Split lead waterproofed	0
Split lead not waterproofed	2
Coaxial Connector	4

3. S.W.R. BRIDGE

S.W.R. Bridge permanently installed	0
S.W.R. Bridge available	2
S.W.R. Bridge—none	8

4. S.W.R. MEASUREMENTS

S.W.R. Center Frequency of antenna as measured with a Cesco CM-52 or CM-52-2 Bridge.	1.2:1 or less	0
	1.6:1 or less	1
	2.0:1 or less	2
	Over 2:1	5
	Over 3:1	10

5. GROUNDS

Tail pipe ground at two points or more—heavy braid	0
Tail pipe ground at two points or more—light braid	1
Tail pipe ground at one point only—heavy braid	2
Tail pipe ground at one point only—light braid	3
Tail pipe—no ground	5

Motor block ground two point or more—heavy braid	0
Motor block ground two point or more—light braid	1
Motor block ground one point—heavy braid	2
Motor block ground one point—light braid	3
Motor block—no ground	5

Rear deck hinges—ground braid heavy	0
Rear deck hinges—ground braid light	1
Rear deck hinges—ground braid—none	5

Hood-ground braid heavy	0
Hood-ground braid light	1
Hood-ground braid—none	5

All ground braids brazed or soldered	0
All ground braids bolted only	5

100

Subtract total of 5 categories —

THIS IS YOUR RATING

HUSTLER MOBILE RATING

Excellent	96-100
Good	86- 95
Fair	76- 85
Poor	Below - 75

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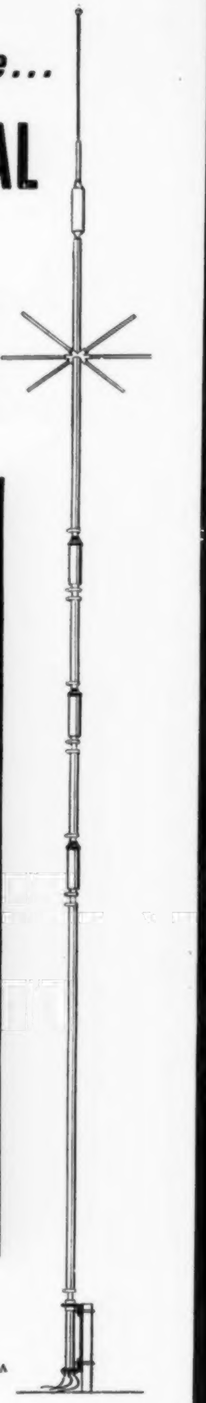

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6439-A

George Allen K1EUJ
74 Wells St.
Westerly, Rhode Island

BC-453 Series Receivers

Simplest Conversion

The BC-453 series receivers can still be obtained from surplus houses or the junkboxes of neighboring hams. This series receiver, while not very selective, is still quite useable as a regular ham band receiver (when the bands aren't too crowded), or as a receiver used in conjunction with an hf of vhf converter. There have been several published conversions for this receiver; however, most of these are involved and do more than just get these receivers working. This article describes a very simple, step-by-step conversion process which will get this receiver operating into a pair of earphones inside two hours, provided you have an available power supply.

The conversion process described in this article was developed and tested on several BC-454 receivers; however, the instructions also apply to the BC-453 (190-550 kc), the BC-455 (6-9 mc), and the BC-946B (520-1500 kc).

Filament conversion

Refer to **Fig. 1** to make the following conversion steps to put the filaments in parallel.

Step 1—Remove bottom plate from receiver.

Step 2—Unscrew the capacitors above sockets B, E, and F in order to gain access to the tube sockets.

Step 3—Observe wire running from pin 7 of socket A to pin 2 of F. Disconnect this wire from pin 2 of F and connect to pin 7 of F.

Step 4—Observe wire running from pin 7 of C to pin 7 of E. Disconnect from pin 7 of E and connect to pin 2 of E. Ground pin 7 of E.

Step 5—Remove the wire running from pin 2 of D to pin 7 of B. Ground pin 2 of D. Run new wire from pin 7 of D to pin 7 of B.
All of the filaments are now in parallel.

George was formerly W3ZIG. He's a physicist (B.S. Muhlenberg) with General Dynamics/ Electric Boat and has published a book "The Asian Tide and Other Poems."

Step 6—Screw the capacitors back in place and put the bottom plate back on.

Wiring front panel adapter

The following parts will be needed to complete the conversion: 1-s.p.s.t. toggle switch for bfo switch, 1-earphone jack, 1-small 20 k pot. (anything between 5 k and 50 k will work) this pot must be physically small so it can be mounted on front cover plate.

Step 7—Remove small cover plate from the front panel of the receiver. Remove the female plug from this cover and discard.

Step 8—Drill this cover plate to take the jack, switch, and pot. (no parts layout is given for this step since it is assumed junkbox parts will be used. Needless to say, junkbox parts vary considerably.)

Step 9—Make the connections as shown in **Fig. 2** by soldering directly to the exposed pins.

Step 10—Screw the cover plate back on to the receiver being careful not to short the components on the cover plate.

Power connections

Fig. 3 shows the power connections to be made to the dynamotor socket on the top-rear of the receiver. If your receiver still has the dynamotor attached, remove it completely and add it to the junk box. B plus voltage of 100 to 220 volts may be used. I use a B+ voltage

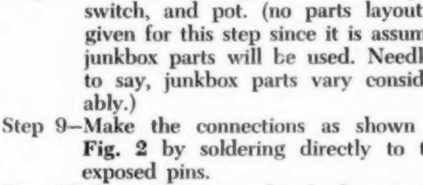

Fig. 1. Location of parts of the BC-453 series receivers.

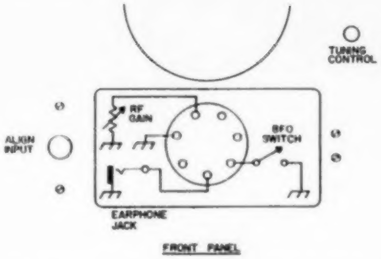

Fig. 2. Connections to the front panel plug.

of 180 v and get excellent results. If you have 12v filament voltage available (ac or dc), you may use the tubes supplied with the receiver, however, if you only have 6 v filament voltage, it will be necessary to make the following tube replacements:

Replace 12SK7 by 6SK7
Replace 12A6 by 6K6
Replace 12SR7 by 6SQ7
Replace 12K8Y by 6K8

Operation

Connect a set of headphones to the jack installed on the front panel, connect any antenna to the antenna jack, hook up a power supply and you're ready to go. Adjust the pot (the rf gain control) to a comfortable listening level, peak the "align input" control to maximum volume and then readjust the rf gain control.

When I converted my BC-454, I was a bit dismayed to discover that I had no tuning knob for the receiver. I did, however, have a few scraps of old rubber tubing of 3/16 inch inside diameter. Tubing of this size slips easily over the tuning gear and makes an excellent tuning device.

The receiver as it stands with the 6 or 12 volt set of tubes is quite sensitive; however, additional sensitivity may be obtained with 6 v tubes by replacing the 6SK7's by surplus 717A's.

. . . K1EVJ

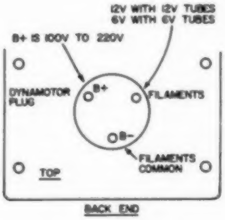

Fig. 3. Power connections to the receiver.

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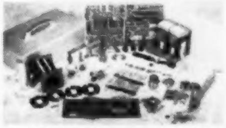

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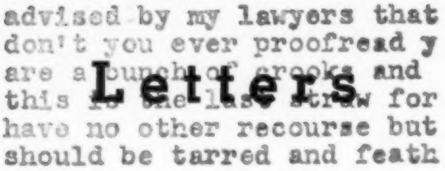

advised by my lawyers that
don't you ever proofread y
are a bunch of crooks and
this is the last straw for
have no other recourse but
should be tarred and feath

Letters

Dear 73:

I've had many requests for help from USA amateurs concerning putting 12 volts in VW's as in my article in the March 73. A new possibility is a three phase generator for the VW 1200 and 1300. It is made by Bosch and is shorter than the traditional generators so can be mounted without altering the hitter-system. You can buy the necessary fittings from Bosch. If you want to make your whole car 12 volts, you must not break up the 6 volt generator or the fan of the air cooling system would not be driven.

I will gladly be of help in supplying the parts.

Hein Ahlers DJ2UL
Oldenburg, Germany

Dear 73:

There will be a Korean QSO Party from 2400 GMT 2 July 66 until 2400 GMT 4 July 66. Present plans call for maximum participation from the HL9's and it is hoped that the HM's will also participate. The party will be held on all bands and all modes.

An appropriate award will be made to the station outside Korea submitting logs with the most HL9 and HM contacts during this period. Logs should be sent to Eight Army Radio Club, Electronics Craft Shop, 19th General Support Group, APO San Francisco 96301.

So here's a chance to get Korea for that DXCC and also a chance to get the Kimchi Award sponsored by the Eight Army Radio Club.

Martin L. Smedley WA3ERL
Sec/Treas
Eight US Army Radio Club

Dear Wayne:

I just received the April issue of QST and turned to the Sweepstakes results. I feverishly searched for my score as this was my first SS. Seventh in L.A., not bad. As I looked over the other scores I was astonished by the obvious and flagrant cheating most section winners displayed in submitting their power multiplier. It seems mine is the only station placing in the top ten in L.A. using over 150 watts input. Disregarding that, I know for a fact that this is not true. It must be obvious to any contest participant that it is almost impossible to rack up a huge score using low power. You cannot control a frequency using under 150 watts in the heat of the contest. I feel especially sorry for those stations who accurately reported their score only to be pushed out of a section win by a ham who lied about his power. This practice induces those who wish to be honest to cheat so that they may compete on the same standard as the big guns. The ARRL obviously recognizes the situation and by their silence sanctions this practice. Wayne, take over now.

Ken Feldman WB6FRP
Los Angeles, California

Alas Ken, many of us have been asking that this stupid rule of the Sweepstakes be changed for many years, but to no avail. It has always been that way and I suppose it always will be. In my first SS participation, back in 1941, 25 years ago, the complaint was the same. Virtually all of the winners had to cheat to win. Great for the sport, eh?

It was difficult to figure out from the mish-mash report in QST on the 1965 Sweepstakes, but, neglecting that finky power multiplier, it looks as if WA4NGO in Florida with 926 contacts in 73 sections was first and W2NSD/1 in New Hampshire with 823 contacts in 73 sections was second. And I'm embarrassed for the League and the 16 other "winners" who claimed they were using under 150 watts and took the multiplier. Ken, we all know how much power these fellows were running.

Dear Wayne,

Can you or anybody else tell me why in the name of statistics do we have to have forty-eight hours of DX contest on the weekends?

There is enough activity going on during a normal weekend to prove most anything; furthermore, DX operation of the rag-chewing variety gives a more concrete idea how good the equipment and band conditions are. *If it* is necessary to gather statistics to prove that the amateur bands are overcrowded, I would say that a mid-week contest would be far more convincing, because there would have to be some sacrifice on the part of the participants whose free time normally falls on the weekends.

I think that these two day contests are in poorer taste than the DXpeditions. Granted that everyone likes to work a new QTH, but just what a fleeting period of operation in another wise non-communicative location proves, except that there are no radio deadspots, is more than I can see. If the time and money spent for these expeditions was contributed to the establishment of an amateur club among the inhabitants of these regions, then there would be some lasting benefit to world-wide amateur radio. What do you say?

Herbert Heath, Sr. DJ0KK

April Issue

It's a bit hard to print, but W0AIO apparently didn't like Annie, so he sent us a skunk along with the Annie torn out of his cc. Paul.

Dear 73:

Today I received my April 73. Congratulations to you and Wayne Pierce on a job well done. For next year how about a foldout of a . . . well . . . uh . . . you know . . .

John Hall WN2UHK
Hornell, N.Y.

PS. I'm a minor, so please send future issues in an unmarked wrapper.

Dear 73:

Please rush me another copy of the April 73. Some *#%&@¢ stole the centerfold from mine.

Nemo

Dear Paul:

73 arrived today. Noting the cover, quickly turned to the center page fold-out of a bare foot VOA transmitter. But it wasn't there.

Think the short note about the author of some articles is very good. Let us know who the authors are.

Dave WA9BQQ
Chicago, Illinois

Dear Sir:

Just received the very mediocre April 73.

You must really be hard up for articles and useful information.

After looking at the (CENSORED) [sic] on pages 124, 125 and 126, will you please reconsider? If you can't come up with anything better than that, please leave three pages blank so I can at least use them for scratch paper.

W. A. Sayles

Dear Paul:

Re your question on comments about the contents of 73 in April.

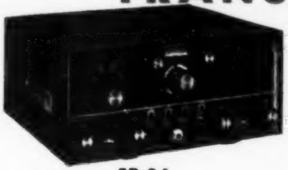
Only a CB column is missing to make 73 jack of all and master of none. Pages 51 [Ham Word Play] and 124 [Annie] stink, 38, 80 and 86 are very good and 7 is juvenile. 82 and diode checker are out of CQ and QST.

All in all 73 is not too bad even if Wayne always wants help or money for his projects; he is as bad as I am but then he does not like me anyway.

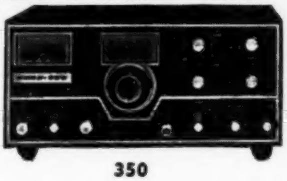
VE6TW

Thanks for your comments. Wayne says he doesn't even know you. How can he dislike you? Paul

TRANSCEIVER HIT PARADE



SB-34



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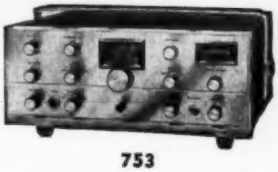

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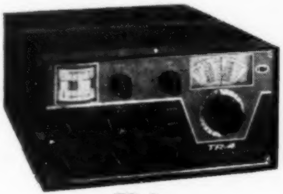

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73, Stan Burghardt WØBJV

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Standard Frequencies

Dear 73:

"Standard Frequencies," a short article in September 1965 73 said ". . . 1000 cycles (is available) from the telephone company by dialing any local exchange followed by 9945." It should have added "in the New York City area." Apparently each Bell Telephone division has a different number for its 1000 cycle test tone. In the Minneapolis-St. Paul area it is any exchange followed by 4098. Telephone companies are reluctant to reveal the number for fear of overloading the line power-wise, but a little serious spade work will turn it up. I was able to compare the Minnesota and New York City tones with a telephone on each ear, and the tones were identical, so apparently they are extremely accurate as to frequency.

Robert Kuehn W0HKF
West St. Paul, Minn.

Dear 73:

The need for well organized traffic nets on the VHF frequencies is here. One good example of this was the recent blackout in New England, which I understand was handled quite well by the VHF boys in that area. I feel that the amateurs don't realize the importance of these nets until a crisis hits their area and then it's too late to think about organizing a traffic net. We are a group of well trained individuals who could, given leadership and time, set up one of the finest emergency nets ever dreamed of. I am speaking of the amateur who is on the VHF frequencies. There is a need! Over 300 disasters occur in the U.S. every year and the next one could involve you and your loved ones. There are a number of these well organized groups in this country, but then there are others, like the North-South Carolina, Georgia sections that are lacking in emergency groups. Why does this situation exist? One good reason is the lack of activity. Night after night I can sit at the "rig" and hear no signals for 200 miles. Why can't we get the boys on the low bands to do their local rag chewing on 6 or 2 meters? They are crazy to try what they're doing on the 75 meter band: I'll tell you my explanation of the matter. These boys, for the most part, are scared to give it a try. They think that equipment is to hard to get or build. They also feel that there won't be enough people to talk to. These are good reasons on the surface, but when you get right down to fact, they hold no water. You put forth effort and some determination and these problems will no longer exist. If everyone would talk up VHF on the low bands and point out that there are many open frequencies . . . QRM FREE to rag chew on locally, then maybe more people would get on. I have heard too many "slams" against VHF and it hurts. "Sure I'm on 2 meters. I thought everyone was . . . at least all of us that have a telephone . . . ha ha." Or you might hear, "There sure is plenty of space on VHF. I was up there and listened for one whole week and heard no one . . . What did I have on 6? . . . Oh, a sixer into my ten-twenty-forty meter vertical. Sure loaded up good though . . ." What is wrong with these supposedly "skilled technicians"? Can't they read the instruction manual that clearly states that a good beam CUT TO FREQUENCY is needed for satisfactory results? We need more positive thinking towards these bands. If we are to use them for what they are best suited for, that being local QSO's and local traffic and emergencies!!! If more of the low band boys would talk up VHF, or better yet shut their mouths when they don't know anything about them, we would have more activity up on these blessed and peaceful bands . . . or maybe not. Nobody want to be alone. Over the past five years that I have been in S.C., I have heard many stations come and go on 6 and 2 meters. They don't stay, or they do so little operating that they might as well be gone.

The Greenville VHF Society has proposed a plan that might help matters in this area. We would like to form a loose federation of clubs in this Tri-State area (mainly the ones that are interested in VHF), and through this organization, form a well organized traffic net to bind the states together. Furthermore, an exchange of information between the clubs in the form of bulletins, newspapers and/or membership representation for lectures would keep the union alive. If the clubs would consent, an annual conference could be held at which time officers could be elected and at which, outstanding VHF men (such as yourself) and also representatives of manufacturing companies could come and lecture on VHF topics. This would be up to the individual clubs as the federation does not intend to change any of the basic or political structures of the "local club." The federation would be only a supplement or an aid to them.

Needless to say, it would take a lot of time and a great deal of work, but we are willing to take the first step in this matter only if we feel that others will take their share of the load. I have appointed the vice-president of the club to take over the program and to handle any correspondence that there might be. He will be more than happy to receive letters and comment both pro or con. Please address all correspondence to Ron Higgs, WA4ZBV, 106 Clarendon Dr., Clemson, S.C. 29631.

R. P. Gruickshank WA4LTS
President
Greenville S.C. VHF Society

DX Antennas

Dear Paul,

It seems that my article in the April 1966 issue of 73 ("A Look at Antennas for DX," p. 68) has stirred some measure of controversy among the DX fraternity. Letters which have come to me in the last two weeks have largely sought to differ with my statements as to the relative merits of vertical and horizontal polarization for long-distance propagation.

Before commenting on the arguments expressed in the letters, though, let's correct an ommission in the text of the article, as published. It looks as though the typesetter completely missed page 6 of the original typewritten manuscript. In the right-hand column of page 71 there appears a sentence which is partially in italics. This sentence is correct, but the next is not. To correct the article, *substitute all of the following for the incorrect sentence:*

The point of this is that an intelligent choice of antenna height consistent with Figs. 4 and 5 and your pocketbook will get you the best DX signal for the money you have.

Now let's talk about some specific antennas. If you have bought or built the tower that best fits your wallet and radiation angle requirements, it is time to find an antenna with the most gain and front-to-back ratio you can afford. Keep in mind that the radiation angle is almost completely established by the antenna height, not by the type of antenna, with the mild exception of the cubical quad, which will be discussed later.

Of course the cadillac of DX antennas is the rhombic, with the vee-beam a close second. If you can afford it, and have the space, put some up. The design tables are readily found in the handbooks. The average ham, however, must make up his mind between the various types of tower-mounted rotatable arrays. The most popular of these types are the Yagi and the quad, so let's compare the two.

Quad vs. Yagi

Perusal of the reams of information that has been written about the quad and Yagi arrays brings to light some interesting points of difference between the two. Probably the most important difference concerns the radiation angles obtainable from them. For heights greater than one-half wavelength Fig. 4 applies to the quad just like any other antenna. At a height of one-half wavelength or less, however, the quad produces slightly lower angle radiation than the Yagi will. (End correction)

Now in hopes of clearing up the questions posed by those interested enough to write letters, I will reiterate some of the points made in the article.

1. The real interest a DX man has in his antenna is in creating the maximum signal strength at the DX location. If his antenna does this while transmitting, it will also make a superior receiving antenna for listening. So the question resolves itself into this; which

polarization produces the maximum field strength at the distant location? The relative merit of an antenna to produce this distant field strength is evident in its vertical radiation pattern. The important considerations are the vertical angle of the lowest lobe; and the length of the lobe, which represents the field strength generated by the antenna. This disregards gain in the horizontal plane, of course.

2. For equal total antenna heights above average ground greater than one-half wavelength, the vertical and horizontal both produce roughly the same radiation angle at the usual DX frequencies. This assumes that the horizontal antenna is a half-wave dipole, and the vertical is composed of an array of half-wave dipoles arranged collinearly and fed in phase. But (although the radiation angles are about the same), *the horizontal will produce at least 3 db more signal strength in the lower lobe*. This is because horizontally polarized energy radiated nearly parallel to the earth's surface is more completely reflected than is vertically polarized energy.

3. It is true that continuing to stack collinear vertical dipoles to greater and greater heights will produce lower and lower radiation angles. But due to poor reflection characteristics of the actual average ground for vertically polarized energy, *the radiated field strength is simultaneously decreasing in these lower lobes*. The net effect is that a simple horizontal dipole, mounted at the same total height, will radiate a stronger signal to the DX location than will an array of collinear vertical dipoles.

4. Let's take a look at two examples. First, assume a particular ham has a five-eighths wavelength high (about 40 feet) wooden mast for use on 20 meters. He can either run a five-eighths wave vertical wire up the side, or he can mount a horizontal dipole of aluminum tubing on top. The cost would be about the same in either case. Which will produce the better DX signal? Consideration of **Figs. 2**, **3** and **4** in the original article will lead to the conclusion that the vertical radiation angles from both antennas would be about 23 degrees. This is true, but the field strength from the horizontal dipole will be just about 3 db greater. These statements can be proven (with some effort) through use of Equations 27a and 27b, p. 699 reference 2, and the image concept. This was where the computer came in handy!!

5. Another example is a comparison between the antenna shown in **Figs. 2d** and **3**, and a horizontal dipole mounted at one wavelength. Again the total heights are the same, and again the radiation angles will be about the same. But the horizontal dipole will give about 3 db more signal strength at this angle, and would give about 6 db were it not for the fact that the radiation pattern has split into two vertical lobes.

6. The purpose of my article was not to malign the vertical as a DX antenna. After all, many amateurs are having good success with them, and will continue to work their share of the DX. I would simply point out that the horizontal is consistently somewhat superior at frequencies above 10 megacycles, where equal total antenna heights are compared. On the 40 meter band the situation is about a toss-up, with possibly a very slight edge to the vertical, since a 40 meter horizontal dipole can't be supported on a single rickety wooden pole, but a vertical made of wire can be run up the side. For the man who is well-heeled, however, the horizontal will probably buy him better performance if he is willing to spend the money needed to gain the necessary height. On the 80 and 160 meter bands, I consider the vertical to be the best choice.

I hope the foregoing has shed some additional light on the DX antenna problem. For those who might be interested in discussing the problem further I am found frequently on the 40 through 10 meter bands (both SSB and CW), and would be happy to schedule a QSO with anyone to exchange views.

Bob Nelson K6ZGQ/5
San Antonio, Texas

P.S.—The DX antenna here is a tri-bander (20-15-10) at 72 feet.

Dear Wayne,

In response to the letter of Paul Gihring (W9JAB), in the March 73, I would like to correct what seems to be a misapprehension concerning the state of gravitational theory. While no contemporary physical theory is in totally satisfactory condition, it is not true that "any physical explanation or definition for the gravity field has scarcely been touched on." One might begin his reading on the subject with the basic papers of Einstein and others which were first published in the initial decades of this century. (Now available in Dover paperback). A considerable body of published experimental and theoretical materials exists in the literature from that time on until the present, where the work of Wheeler, Dicke and Feynman (to mention only a few) can be found continuing the same tradition in almost any recent volumes of the Physical Review. Unfortunately, the casual reader will have as much or more difficulty in reading these works as did the contemporaries of Maxwell in the last century, upon first encountering his momentous theory.

Still, I would hate to see this discourage the amateur experimenter. The fresh and unprejudiced point of view has nearly always proved fruitful for the progress of our knowledge of the physical universe, and this may be no exception. It may also be that the extreme care needed in observing effects known to be so small is not outside the realms of possibility for today's advanced hams.

Andrew J. Dufner WA7CXW/6
Los Gatos, Cal.

WTW

Dear Wayne and Gus:

I received the dope on WTW this morning and am glad to see someone come up with a sensible award for DXers. You can count on me trying to be one of the first WTWers from the fifth district. I used to be very active in DX back when Wayne was at CQ and Dick KV4AA was DX editor, but after the way CQ and ARRL has run their DX departments I just haven't had the enthusiasm I used to have back when I organized the West Gulf DX Club and was its president for the first two years.

Bob Wagner W5KUC
Honey Grove, Texas

Corrections to Articles

Dear 73:

I don't mean to nit-pic the feedline article by WØOPA in March because I enjoyed it very much, but in Fig. 3, I believe that Harvey meant for the antenna to be a folded dipole rather than a single dipole. For just a dipole, the balun should have been a 1:1 matching transformer or a bazooka.

David Clingerman WA3CCN

Dear 73:

Regarding the article on "diversity" in the April 73, page 92: Diversity recombination must be done after the detector, so that all RF phase info is lost. Otherwise there will be RF cancellation regardless of the number of antennas. There is a reason for the use of the two receivers and the author should have realized this.

Tom Lamb K8ERV
Mansfield, Ohio

Dear 73:

Fine article by John Nelson about Current Propagation.

Suggest that you run a warning in next issue cautioning against looking directly at the sun thru a telescope, binoculars or other device. Even with a smoked glass or other filter one could receive permanent damage to the eye. The best way is to reflect the image on to a white card where one may safely examine the sun's surface.

Hal Burnham K4WIQ
West Palm Beach, Florida

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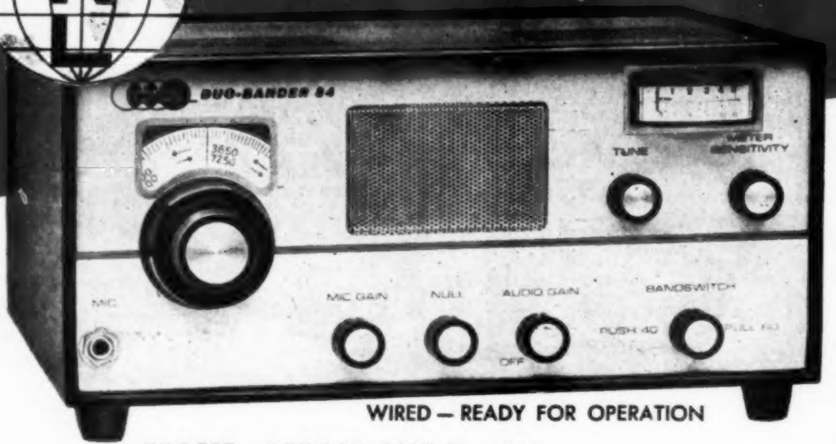
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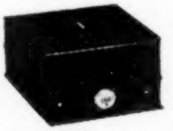

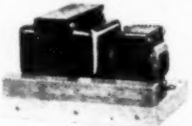

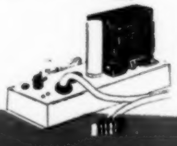

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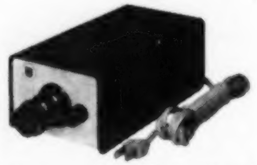
NEW PRODUCTS

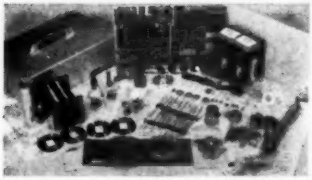
Polytronics PC-6CD

You're all familiar with the excellent Poly-Comm PC-6. Now Polytronics is making a new model, the PC-6CD, that's civil defense approved in addition to all of the other features you know. The price is only $199.95 direct or from your dealer. Incidentally, Polytronics has recently been bought by Vitro Corporation of America, a large company well known to readers who are engineers or in the industry. We hear that they have some very interesting new products in the works. Polytronics, 900 Burlington Avenue, Silver Springs, Md. 20910.



S-S S-S TV Camera

Squires-Sanders has just announced a new low cost, high quality solid state TV camera smaller than a telephone. The camera, the SS-310, delivers high resolution pictures on video monitors or conventional TV receivers, and may be linked to as many screens as desired. The camera contains 19 silicon transistors, 2 germanium transistors and 14 diodes. A noteworthy feature is its automatic light level control to insure clear pictures under virtually all conditions. Price of the SS-301, with f1.4 lens and 25 feet of cable, is only $289.95. Squires-Sanders also is making a large number of accessories available and the man to write for more information is Dick Marten at Squires-Sanders, Martinsville Road, Millington, N.J. 07946

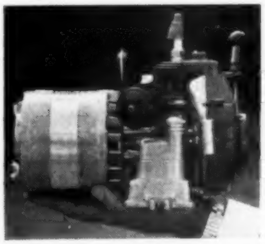


ATV Research Transistor Camera Kit

ATV Research has put together an easy-to-build kit for an inexpensive transistorized TV camera. The kit with all parts including the pc board, but not the vidicon (which you can often get free) costs only $149.50. They also make the manual for the camera available for $5.00 (refundable with order) and hard-to-find components for the transistor camera or a tube-type camera can be bought for correspondingly reasonable prices. Send for their fascinating free catalog today. ATV Research, P.O. Box 396, S. Sioux City, Nebraska.

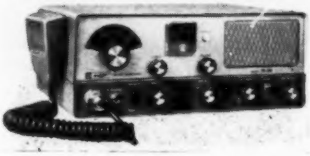
E-V 602F Mike

The new Electro-Voice 602F handheld dynamic mike is especially designed for mobile and other high noise applications with its noise cancelling features. The 602F has a positive, highly reliable detent switch and the whole mike is ruggedly built. Price is $57.50 from E-V distributors. You can get more information from Lynea Dalrymple (!) at Electro-Voice in Buchanan, Michigan 49107.



Tiny Tor

Bet you'd like one of these—and you can afford it, too. It's the Tiny Tor alternator that supplies up to 350 watts 115 volts AC, 6/12 volts DC—yet it weighs only 12 lbs., is only 7½ x 10¼ x 8½", is all-metal in construction, requires no batteries for starting and uses a high quality Ohlssen and Rice ¾ HP, 2 cycle recoil start engine. The price is a fantastic $79.50 and it's fully guaranteed: Algert Sales, 1805 Wilshire Blvd, Los Angeles, California 90057.



Knight-Kit 6 Meter Transceiver

The new Knight-Kit TR-106 6 meter transceiver is going to attract a lot of attention. It covers 50-52 MHz on receive with nuvistor rf stage for a .5 μv sensitivity, and 8 kHz bandwidth. The receiver is double conversion, so has high image and *if* rejection. The transmitter runs about 15 watts input to the final with high level plate and screen modulation. The TR-106 uses 8 MHz crystals or the Knight V-107 VFO. Both AC and transistor 12 volt DC power supplies are built in. Price for the transceiver kit is a low $139.95 and the VFO kit is $19.95. They're sold by Allied Radio, 100 N. Western Avenue, Chicago, Illinois 60680.

UHF Semiconductors from TI

Texas Instruments has recently introduced some new UHF and microwave semiconductors that look interesting. One is a Schottky-Barrier UHF mixer diode (TIV305) ideal for UHF tuners and microwave mixers. It has a typical noise figure of only 6 db at 900 MHz (mc) and a very low total capacitance to reduce the possibility of interference to other receivers. Local oscillator power requirements are very small, too. One of its big advantages is very rugged construction—it uses no delicate cat whiskers for contact. Price is $3.25 for one. Another new product is a microwave germanium planar transistor (TIXM103 and 104) that can replace TWT's, tunnel-diode amplifiers and paramps—economically. It's a good amplifier and offers up to 6.5 db gain at 3 GHz with a 5.5 noise figure. Typical NF at 1.5 GHz is 3.8 db. The price is $82.50 apiece for the 103 (takes three to replace a TWT), but compare that to typical TWT's at $2600. Also, they're much smaller, last longer and take much less power. Another TI semiconductor is the TIXS39, an NPN epitaxial planar silicon transistor ideal for transmitters. It features low IM distortion, f_T over 1 GHz, typical power gain of 13 db at 200 MHz and 3 watts dissipation. You can get more info from your TI distributor or TI Tech Service, P.O. Box 5012, Dallas, Texas 75222.

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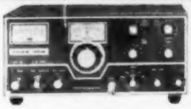

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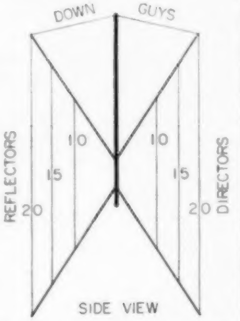

At last . . . a quad antenna that will really stay up in the air. Not a tri-band, but actually three antennas in one. Each band has a spacing of 0.15 and an input impedance of 52 ohms. Therefore when fed with a single RG-8/U coaxial feedline, the SWR is 1.5 to 1 or less on all bands. It requires no loading coils, no baluns, and will handle a full 2 KW PEP. This quad has a forward gain of 8 db, a front to back ratio of 25 db and a front to side ratio of 50 db. Physically this quad is 17⅓ feet long, has a turning radius of less than nine feet yet weighs only 21 pounds. The lightweight construction of fiberglass rod and aluminum tubing is extremely strong but at the same time permits the use of a low cost TV rotator. In fact, an antenna of this type has been up for 3½ years at my QTH and stayed up in 65 mph winds with a simulated ice load of 20 pounds.

These tri-band quad antennas come complete with all fiberglass and aluminum spiders, #14 antenna wire, 250 pound test nylon guys, all assembly hardware and complete assembly and tuning instructions. Shipping weight—28 pounds. (For pictures of the quad at my QTH see page 91 of the April 73). $99.95
For mounting rotors down inside the tower, a 1½ inch diameter, six foot long aluminum tube is available for an additional $2.50

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Alco Readout Indicators

Alco has just announced a new digital readout indicator that should appeal to many experimenters. It comes in two models, for 6 volts or 14, and includes the ten digits and a period. The indicator is only about 2½ x ¾ inches, so should fit just about anywhere. You can get more details from Alco Electronic Products, Lawrence, Massachusetts.

No-Mar Antenna Mount

Newtronics has just announced the new TGM-1 trunk groove antenna mount that permits you to mount your mobile whip without drilling any holes in your car's finish. The mounts don't interfere with trunk closing and are fully adjustable. Price is only $3.95 in chrome-plated steel or $4.95 in stainless. See your distributor for more information or write Jim Taylor W8EEC at Newtronics, 3455 Vega Avenue, Cleveland, Ohio 44113.

Drake SW-4

Serious SWL's should make sure that they get the complete specifications on the new Drake SW-4 international short wave broadcast receiver. It covers 6-6.5, 9.5-10, 11.5-12, 15-15.5, 17.5-18, 21.5-22, and 25.5-26 MHz with the crystals supplied and offers many of the features of the well-known Drake R-4A, though adapted specifically for SWBC listening. Price is $289.00 and you can get more information from R. L. Drake Company, 540 Richard St., Miamisburg, Ohio 45342.

Higher Power for TA-33 Jr.

Owners of Mosley TA-33 Junior Trap Master antennas may now have higher power by replacing the TA-33 Jr. radiator element with the MP-33 Tig-Array radiator element (MPK-3 Kit). Then the antenna will handle 750 watts AM/CW or 2000 watts PEP SSB. Write to Mosley, 4610 North Lindbergh Blvd., Bridgeton, Missouri 63042.

40 meters with your MP-33

You can use your new Mosley MP-33 Tig-Array on 40 by adding a 40 meter rotatable dipole (Kit TA-40KR) to it. Addition of the TA-40KR doesn't change any of the MP-33's electrical characteristics. The TA-40KR may also be added to 40 to the TA-31, TA-32, TA-33 and TA-36, or to the modified TA-33 Jr. (see paragraph above). Write Mosley for more information.

Vista 212 Tape Recorder

There are so many cheap junky tape recorders on the market these days that it is hard to know what to buy when you decide that you need something along this line. Most of us have probably been stung in our first buy, or at least have a friend who did.

While out in Los Angeles I dropped in at Radio Products Sales and they were featuring the Vista 212 for under $40. This, if it worked, looked like just what I needed. It could be used on the operating table to record DX contacts that I wanted to play back later . . . an accessory phone pickup was available so I could record phone calls I wanted to remember . . . and I could take it to club meetings and hear my talks over again to see where I might improve them. The little thing only weighed 4½ pounds, complete with batteries.

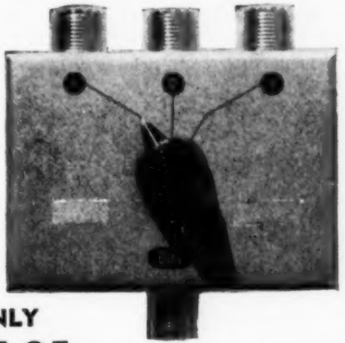
Naturally I bought one. I think the small size (8" x 10" x 3") made it particularly attractive for it was small enough for me to pack along on my trips. I also liked the two speed facility so I could record music, if I wanted, at the higher speed and most of the rest of my stuff at the slow speed which would give me an hour of recording on the 3½" reel of tape on each side. Another good feature was the automatic level for recording . . . there was no control for this, it just set the level automatically and I found that it would record voices across the room as well as my own right up close.

This little recorder goes everywhere with me now and I have not had a moment's regret about buying it. When I'm home it sits on my desk ready to record from the phone or off the air. When I'm away I pack it in a corner of my bag. I find the recorder to be quite reliable and simple to operate.

. . . W2NSD/1

Motorola Semiconductor Data Supplement

A few months ago we mentioned the new Motorola Semiconductor Data Manual, a fat, full listing of all the Motorola Semiconductor devices with their complete spec sheets and some other useful information. Well, Motorola hasn't been sitting on their hands, as the new Supplement 1 to this manual proves. It costs $1 and lists all of their newer semiconductors. You can get a copy from your Motorola distributor or from TIC, Motorola. Box 955, Phoenix, Arizona 85001.



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- Handles more than 1000 watts of power
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- May be cascaded
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- Durable satin-etched finish
- Fantastic low price of $5.95

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SWAN is "Big DXer's" Choice !

Shown to the left is "Butch" Greve, W9EWC (Eat Wisconsin Cheese), operating his new SWAN 400 mobile rig. Butch, who started operating in 1925, has confirmed hundreds of countries and holds many DX Contest Certificates. The W9EWC home station is located at #1 Cheddar Lane, Hilbert, Wisconsin. When Butch is not Hamming, he is busy manufacturing the famous Wispride Cheese.

TERRY SEZ . . .

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W9DIA
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AFTER JUST $5⁰⁰ DOWN

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100kc Calibrator Kit for 350		19.50
Deluxe Mobile Mounting Kit		19.50
10 Meter Full Coverage Kit (early 350's)		15.00
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45 Swantenna – Manual	(2.16)	65.00
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14-230 12v. DC Supply w/230v. Basic	(4.51)	130.00
117-X Basic 117v. AC Supply only	(2.16)	65.00
230-X Basic 230v. AC Supply only	(1.52)	75.00
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Cabinet & Speaker w/AC line cord		20.00
117v. or 230v. line cord		5.00
8 foot power supply cable		3.00

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I enclose $__________, I will pay balance (if any)

☐ COD ☐ 1 year ☐ 2 years ☐ 3 years

Name ____________________

Address ____________________

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State ____________________ Zip __________

☐ Send Reconditioned Equipment Bulletin

Propagation Chart

JUNE 1966

J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7*	7	7	7	14	14	14	14	14
ARGENTINA	14*	14	14	14	7	7	14	14	21	21	21*	21
AUSTRALIA	14	14	14	7*	7	7	7*	7	7	7*	14	14
CANAL ZONE	21	14	14	14	7	7	14	14	14	21	21	21
ENGLAND	14	7	7	7	7	7	14	14	14	14	14	14
HAWAII	14	14	14	14	7*	7	7	7*	14	14	14	14
INDIA	14	14	7*	7*	7*	7*	14	14	14	14	14	14
JAPAN	14	14	7*	7*	7	7	7	14	14	14*	14*	14
MEXICO	14	14	14	7	7	7	14	14	14	14	14	14
PHILIPPINES	14	14	7*	7*	7*	7	7	7*	14	14	14*	14
PUERTO RICO	14	14	7*	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7*	7	7	7*	7*	14	14	14	14	14	14	7*
U. S. S. R.	14	7*	7	7	7	7*	14	14	14	14	14	14
WEST COAST	14	14	14	14	7	7	7*	14	14	14	14	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	14	7*	7	7	14	14	14	14	14
ARGENTINA	21	14	14	14	7	7	14	14	14*	21	21*	21
AUSTRALIA	14	14	14	14	7*	7*	7	7*	7	7*	14	14
CANAL ZONE	21	14	14	14	14*	7	14	14	14	14*	21	21
ENGLAND	14	7	7	7	7	7	14	14	14	14	14	14
HAWAII	14	14	14	14	7*	7	7	7*	14	14	14	14
INDIA	14	14	7*	7*	7*	7*	7*	14	14	14	14	14
JAPAN	14	14	14	7*	7	7	7	14	14	14	14*	14*
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	7*	7*	7*	7	7	7*	14	14*	14
PUERTO RICO	14	14	14	14	7	7	14	14	14	14	14	14
SOUTH AFRICA	7*	7	7	7*	7*	14	14	14	14	14	14	7*
U. S. S. R.	7*	7*	7	7	7	7	14	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	14	7	7	7	7	7	14	14	14
ARGENTINA	21	21	14	14	7	7	7	14	14	21	21*	21*
AUSTRALIA	21	21	21	14	14	14	14	7	7	7*	14	21
CANAL ZONE	21	21	14	14	14	7	7	14	14	21	21	21
ENGLAND	14	7*	7	7	7	7	7	7*	14	14	14	14
HAWAII	14	21	21	14	14	14	14	7	14	14	14	14
INDIA	14	14	14	14	7*	7*	7*	7*	14	14	14	14
JAPAN	14	14	14	14	14	7	7	7	14	14	14	14
MEXICO	14	14	14	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	14	14	7*	7	7	14	14	14	14
PUERTO RICO	14	14*	14	14	14	7	14	14	14	14	14	14
SOUTH AFRICA	7*	7*	7	7*	7*	7*	7*	14	14	14	14	7*
U. S. S. R.	14	14	14	14	7	7	7*	14	14	14	14	14
EAST COAST	14	14	14	14	7	7	7*	14	14	14	14	14

Very difficult circuit this hour.
* Next higher frequency may be useful this hour.

Good: 1-4, 6-8, 10-13, 17-20, 22, 23, 25-28
Fair: 5, 9, 14, 24, 29, 30
Poor: 15, 16, 21
VHF DX: 3, 8, 9, 16-18, 29, 30

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- 2-30 MC
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Nearly perfect characteristics are obtained by the use of low loss ferrite materials and special winding techniques. The transformer is completely encapsulated in plastic to assure freedom from moisture or shock damage. Model 601 is designed for a 1:1 ratio (50 ohms unbalanced to 50 ohms balanced) and the Model 601A is available for applications requiring a 4:1 ratio (50-200 ohms or 75-300 ohms). Each unit is supplied with a UG58A/U (type N) fitting to provide superior weather resistance.

$19.95 Plus Postage with mating UG21B/U add $1.00.
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BROAD BAND BALUN **$10 net ppd. in U.S.A.**

● Flat in the amateur bands from 3 to 30 Mcs. ● Full legal power ● Fully weather sealed ● Matches coax to antenna or balanced line. ● Improves efficiency and radiation pattern.

Two models, 1 to 1 or 4 to 1 impedance ratio
Size 1¼" OD x 4" long. Wt. 4 oz.

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Howard Pyle W7OE
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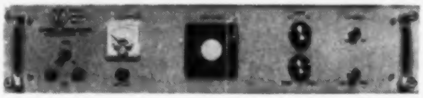
Boy! Do You Want a Law Suit?

Have you got five, ten, maybe fifty thousand bucks salted away? (Who has?!). Bet if you have you'd like to keep it! Most of us would so why hang it on a convenient tree limb for anybody to shoot at?

Do you know that you are doing just that if you have a guy wire from an antenna mast or rotary beam support tied to a stake in the ground or an equivalent anchor? Maybe even one or more guys for your TV mast fall in this category as well. Sure they're 'inconspicuous' . . . you planned 'em that way so that they wouldn't be a neighborhood eyesore but you'd better do something about the first six feet or so above the ground anchor. Just let a man or woman, boy or girl trip over an unseen guy wire, particularly in the dark, and maybe break a leg, an arm or a basketful of ribs and you're in trouble! They can sue you for pretty heavy loot you know, and maybe they will! You can perhaps sue them back for possible trespass on your property but you'll have a pretty weak case; *you* didn't suffer any physical injury. At any rate it can cost you in addition to a heavy award to the plaintiff by a judge probably sympathetic to the latter, rather substantial attorneys' fees to keep such award as far down as you can. Probably you'll also be faced with rather heavy costs to the lawyer who prosecutes your trespass case if you seek to file such suit.

Why not play it safe and avoid such possibilities? Most of us hams who rely on a mast or tower to support our beam or 'sky-wire', as the case may be, have one or more guy wire anchors placed in what are really pretty precarious spots about the yard or garden. These are very definite hazards to those who are not "in the know." You can protect yourself against causing such a hazard by following the example of the utility companies; power and telephone mainly. Ever notice that wherever they find it necessary to locate a guy wire anchor at ground level or thereabouts, they invariably mark the lower six feet or so of guy wire in a prominent manner. The major companies generally use a semi-circular galvanized iron shield, commercially available to them through their pole line supply companies and fitted over the lower end of the guy



ALLTRONICS-HOWARD MODEL L RTTY CONVERTER

Telewriter Model "L" frequency shift converter designed for two-tone AM or FM with limiter operation available by switch. Solid state ratio corrector compensates for fading signals. Permits copying on Mark or Space only. Selector magnet dc loop supply built-in with bias supply and octal socket for optional polar relay to key transmitter. 6W6 keyer tube. Plug-in discriminator for 850 cycle or other shifts. Cathode ray or dual eye indicator. Auto-start control system optional. Prices for 19" rack mounting: Model "L" with dual eye $199. Model "L" with C. R. tube indicator $279. Cabinet $19.50

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ALL BAND TRAP ANTENNA !

Reduces Interference and Noise on All Makes Short Wave Receivers. Makes World Wide Reception Stronger. Clearer on All Bands!

For ALL Amateur Transmitters. Guaranteed for 1000 Watts AM 2000 SSB Pi-Net or Link Direct Feed. Light, Neat, Weatherproof.

Complete as shown total length 102 ft. with 96 ft. of 72 ohm balanced twinline. Hi-impact molded resonant traps. (Wt. 3 oz. 1" x 5" long). **You just tune to desired band for beamlike results.** Excellent for ALL world-wide short-wave receivers and amateur transmitters. For NOVICE AND ALL CLASS AMATEURS! NO EXTRA TUNERS OR GADGETS NEEDED! Eliminates 5 separate antennas with excellent performance guaranteed. **Inconspicuous for Fussy Neighborhoods!** NO HAYWIRE HOUSE APPEARANCE! EASY INSTALLATION! Complete Instructions.

75-40-20-15-10 meter bands. Complete $17.95
40-20-15-10 meter. 54-ft. (best for swl's) Complete .. $16.95

SEND ONLY $3.00 (cash, ck., mo) and pay postman balance COD plus postage on arrival or send full price for postpaid delivery. Complete installation & technical instructions furnished. Free information on many other 160-6 meter antennas.

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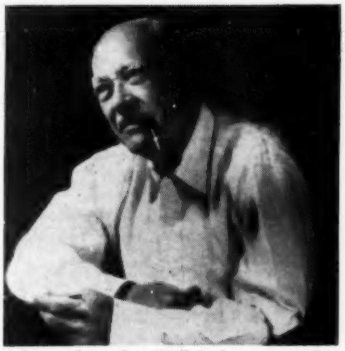
4 El 10	18.00	4 El 6	15.00

ALL BAND VERTICAL: V160 (6 thru 160) 18.95

QUADS: NEW! NEW! ALL METAL (except insulators) Cubical Quads: 2 El; full size; complete with boom, all hardware; terrific gain and directivity; best quad ever made; no bamboo; 20 meter $25; 15 meter $24; remit with order; shipped exp. coll.

GOTHAM, 1805 Purdy Ave., Dept. 73, Miami Beach, Fla. 33139



wire, clamped in place by "U" bolts or similar means. The more modest installations of the smaller companies often use a simple 1"x4" board about five or six feet long, also secured to the lower end of the guy wire with "U" bolts or similar and generally painted with aluminum or gloss white enamel. Either of these methods is good and it gets them out of the "court-room woods." In other words, ". . . if you can't see it and as a consequence fall over it, 'taint our fault; we marked it plainly!"

You can even beat that and generally at no cost or, at most, a few pennies. Before you tie your ground wire(s) into the ground anchor, slip a piece of half or three-quarter inch pipe over the wire so that its butt rests against the anchor. If you don't have such a piece of scrap pipe you can pick up a suitable length of iron or aluminum tubing from your local hardware or building supply dealer for a nominal sum. If pennies really count, use a five or six foot length of rubber or plastic garden hose. Whatever you use though, paint it with shiny aluminum or gloss white enamel . . . something which will make it discernible even on a dark night. If you're a stickler for 'perfection' you can even stripe it like a barber pole using a fluorescent reflecting enamel. Regardless of what you do to solve this problem, you have shown good faith in warning the general public that there is an obstruction . . . take care! It's liable to save you all of your bonds and your savings account in the long run!

. . . W7OE

YB of W7OE is well-known to 73 readers. His early calls (he's 68) were MA, HP before 1912 radio laws), 7HP . . . 7OE, etc. YB is a retired electronics engineer with the U. S. Government and has written several thousand articles and nine published books since he was first published in Gernsbacks' Modern Electrics in 1912. YB is strictly a CW man and has never had phone equipment.

THE SHACK OF W2XCQ

IDENTIFY YOUR SHACK

Your call attractively displayed, inside or outside. Lasts for years. 2½ x 17¾ inch, custom made—fully guaranteed—distinctive design of quality rust proof aluminum, finished in rich, black enamel. Beaded, Reflective, Raised lettering.

Door or Wall mount (pictured) $1.45

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READY TO OPERATE RECEIVING TRANSMITTING TERMINAL EQUIPMENT FOR RTTY

- **TUCK'S RTTE—series provides unitized station operation—yields shifts of 850/600/400/170 cps.**
  - **RTTE-3 for 2975-2125 cps**
  - **RTTE-4 for 2125-1275 cps**
- **Performs all RTTY functions without patching.**
- **Provides proper keying voltage for diode type FSK for lower bands, AFSK for SSB and 2 and 6 meters.**
- **No patch panels, polar relays, or external power supplies needed.**
- **FREE LITERATURE, COUNSEL.**

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2331 Chestnut Street, Camp Hill, Pa. 17011

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FUNDAMENTAL FREQUENCY

HERMETICALLY SEALED CRYSTALS

$1.50 EA.

4 for $5.00

in HC6/U HOLDERS

ORDER BY TYPE AND FREQUENCY

The CR18/U is a hermetically sealed plated crystal fundamental frequency to be used in parallel oscillator circuit of 32 mmfd. Tolerance is .005% from −55° to +90° Centigrade. It may be used to double, triple, or quadruple, to any desired frequency. Maximum drive is 10 milowatts.

833.0
1300.0
1325.
1400.0
1500.0
1589.
1665.0
1710.0
1725.0
1735.0
1765.
1771.75
1773.13
1781.
1780.62
1786.87
1843.75
1845
1869
1900
1911.95
1913.60
1916
1916.85
1922.30
1923.75
1927
1931.0
1937.50
1939.55
1985
1987
2001
2007.50
2028
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2072
2080.25
2135.75
2146.75
2151
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2158
2159.5
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2174
2176.50
2178
2186
2183.62
2194.12

2198.75
2203.50
2207.06
2207.383
2208.31
2209
2212.06
2214.36
2217.93
2219
2219.75
2223.25
2226
2230.25
2237
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2243.30
2246.0
2247.75
2250.0
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2654.25
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2680.75
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2762.37
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2855.25
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3035.5
3052.5
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3143.5
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3203.5
3207.25
3217.5
3231.5
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3248.87
3253.62
3255
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3285.0
3375
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3630.0
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3805
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4203.70
4210

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4252
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4750.0
4765.62
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4900.5
4993.75
5000.0
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5437.5
5533
5580
5610
5626
5730
6003.28
6038.62
6061
6091.66
6098.14
6103.70
6109.25
6114.93
6120.37
6125.92
6131.48
6137.03
6142.59
6148.14

6153.70
6159.25
6164.81
6173.70
6175.92
6181.48
6183.33
6187.03
6192.59
6198.14
6200.0
6203.70
6210
6238.30
6261.11
6316
6330
6366
6400.0
6425.0
6450.0
6455
6500.0
6516
6528
6534.44
6535.98
6591.66
6603
6618.75
6627
6636
6630
6661.11
6696
6705
6708.75
6716.66
6727
6738
6750.0
6758.3
6761
6765.55
6772.22
6783
6788.88
6800.0
6805
6840
6850
6872.25
6877
6883.33
6887.5
6888.75
6894
6900.0

6905
6907.5
6916
6922.22
6925.0
6927
6933
6938
6944.44
6950.0
6955
6961
6966
6972.22
6977
6983
6986
6988.88
6996
7000.0
7005.5
7010
7022
7027.7
7030.55
7038.88
7061.11
7083.3
7091.66
7100.0
7105.55
7111.11
7137.5
7150.0
7172
7185.5
7247.5
7250.0
7258.33
7260
7270
7278
7305.55
7338
7365.0
7365
7375
7383.75
7387.5
7395.0
7400.0
7415.0
7518.33
7425.0
7428
7433
7450.0
7458

7665
7673
7515
7516.66
7548.75
7561.11
7575.0
7585
7591.66
7600.0
7637.5
7638
7630.0
7665
7685
7715
7750.0
7750.33
7775.0
7822.22
7838.88
7830.0
7867
7886
7887.5
7894
7925.0
7960
8000.0
8006.66
8040.0
8043
8064.28
8071.4
8078
8085
8090.76
8091.66
8107
8120.2
8137.5
8140.0
8142.8
8148
8152
8157.14
8160
8164.28
8167.05
8169.23
8171.2
8176.92
8185.5
8185.71
8192.85
8199.09
8200.0
8205.0

8216.25
8221.42
8226.5
8223
8227.5
8228.57
8233
8236.3
8240
8246.66
8248.0
8250.0
8253.3
8258.33
8261.11
8268.75
8273.33
8275.0
8285
8287.77
8292.31
8294
8298
8300.0
8302
8307
8317.5
8338.46
8342
8340
8346.15
8347.5
8350.0
8352.7
8358
8362
8372.2
8376.92
8385
8387.5
8407
8415
8435.7
8450.0
8452
8469.2
8471.4
8500.0
8516.6

8550.0
8552.7
8572.2
8586.6
8598
8611
8625.0

8637.5
8650.0
8661.11
8666.66
8683.5
8705.55
8750.0
8775.0
8786
8783.5
8790
8791
8808
8842
8850.0
8887.5
8910.0
8950.0
8977.5
9019.44
9026
9027.5
9045
9061.11
9067.5
9108.33
9125.0
9135.0
9141.6
9150.0
9300.0
9322.3
9327.77
9337.5
9350.0
9375.0
9412.5
9427.5
9472.5
9500.0
9537.5
9547.5
9552.77
9562.5
9572.22
9577.5
9579.16
9637.5
9642.5
9683.33
9697.5
9703.0
9750
9777.77
9787.5
9794.44
9888
10.0000

10.1938
10.3000
10.4666
10.5150
10.6262
10.6666
10.6916
11.0000
11.0200
11.0400
11.1111
11.1125
11.2500
11.2562
11.3190
11.4962
11.5000
11.5183
11.5407
11.5629
11.6185
11.6296
11.6510
11.6518
11.6740
11.6960
11.7074
12.3000
12.5178
12.6000
12.7666
13.0000
14.3265
14.6930
15.3100
15.9500
19.7166
19.7500
19.7833
19.8166
19.8500
19.9166
19.9500
19.9830
20.0600

CRYSTALS LISTED ARE FUNDAMENTAL FREQUENCIES. WE WILL MAKE TO ORDER ANY FREQUENCY FROM 2000KC TO 12000KC IN HC6/U HOLDER .005% TOLERANCE AT

$2.55 EACH

BE SURE TO SPECIFY EXACT FREQYENCY AND CIRCUIT IT IS TO BE USED IN TO INSURE CORRECT CORRELATION.

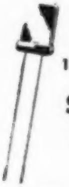
DELIVERY ON SPECIAL FREQUENCIES CAN BE MADE IN 48 HOURS AFTER RECEIPT OF ORDER.

IN STOCK

HC18/U

Wire Leads

1½" for soldering



$1.60 EA.

4 for $5.00

MINIATURE WITH WIRE LEADS FUNDAMENTAL FREQ. IN MC

8.2500
10.6666
11.6666
12.0000
14.0000
14.0500
14.1000
14.1500
14.2000
14.2500
14.3000
14.9000
16.0000
16.2500
16.5000
16.7500
16.9500
17.0000

17.0500
17.1500
17.2500
17.3500
17.4500
17.5000
17.5500
17.6500
17.7500
17.8500
18.0000
18.2500

THIRD OVERTONE FREQ. IN MC

23.2500
23.7500
24.1000
24.7500
24.9000
25.3000
25.7500

26.2500
26.7500
27.0000
27.2500
27.5000
27.5617
27.6500
27.7500
27.9000
28.0000
28.2500
28.5000
28.7500
28.9000
29.0000
29.2500
29.5000
29.7500
30.0000
30.5000
30.7500
30.9000

31.0000
31.2500
31.5000
32.2232
32.7500
33.0000
33.2000
33.2500
33.4000
33.5000
34.1250
34.1500
34.4444
35.5555
36.1500
36.2000
36.2500
36.3000
36.3500
36.4000
36.4500
36.5000
36.5500
36.6000
36.6500
36.6666
36.7000
36.7500
36.8000
36.8500
36.9000
36.9500
38.1481
38.3333
38.4814
38.5925
38.6290
38.6296
38.9250
38.9629
39.0000
39.0370
39.0740
39.1111
39.1851
39.2222

39.2598
39.2963
39.4075
39.4814
39.5555
39.6296
39.6666
39.7777
39.8148
40.0000
40.0374
40.1111
40.1851
40.2222
40.2963
40.3703
40.4074
40.4444
40.6296
40.6666
40.8888
41.0000
41.0500
41.1111
41.2222
41.2500
41.3333
41.3500
41.4500
41.4814
41.5000
41.5500
41.6500
41.6666
41.7000
41.7500
41.8000
41.8518
41.8888
41.9500
42.0740
42.1111
42.1480
42.1851
42.3333
42.4000

42.0500
42.8500
42.9500
43.3333
44.7400
45.9000
46.3400
46.4000
48.0500
48.3833
48.7166
49.0500
49.3833
49.6700
49.7160

FIFTH OVERTONE

52.5000
52.7166
52.9000
53.0070
53.0500
53.0570
53.1070
53.1570
53.2070
53.2570
53.3833
53.6070
53.6575
53.7075
53.7160
53.7575
53.8075
53.8575
53.9075
53.9575
54.0500
54.3833
55.7160
55.0500

55.3833
56.0500
57.7160
57.8000
57.8500
58.3333
59.0500
60.0000
60.0500
61.0500
61.6750
62.0000
62.1500
64.9920
67.0250
67.9920
68.9800
68.9920
69.9920
70.0000
70.9920
71.9920
72.9920
73.9920
74.9920
75.9920
77.9920
78.0000
79.9920
80.0000
80.9920
81.0000
81.9920
82.0000
82.9920
83.0000
83.9920
84.0000
85.0000
86.0000
87.0000
88.0000
89.0000
90.0000
94.3000

96.0000
97.0000
98.0000
99.0000
99.7667
100.0667
102.0000
102.8600
103.0000
103.2000
103.4600
103.6600
103.6670
103.8600
104.0000
104.2600
104.3600
104.6600
107.0000
111.0000
111.2500

LOW FREQUENCY

PRESSURE TYPE CRYSTALS

JAN
KC
CRYSTALS

TYPE 243

$1.05

EACH

FREQUENCIES LISTED ARE IN STOCK FOR IMMEDIATE DELIVERY

FREQUENCIES ARE IN KC. ORDER BY FREQUENCY

1010
1015
1025
1050
1055
1065
1070
1080
1085
1090
1110
1115
1125
1130
1140

1150
1170
1220
1225
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1260
1265
1270
1275
1285
1290
1300
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1395
1400
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1440
1505
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2085
2090
2095
2100
2105
2110
2115
2120
2125
2130
2135
2140
2145
2150

2155
2160
2165
2170
2175
2180
2185
2190
2195
2200
2205
2210
2215
2220
2225
2230
2235
2240
2245
2250
2255
2260
2265
2270
2275
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2300
2305
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2605
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2645
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2795
2800
2805
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2900

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2985
2990
2995
3000
3005
3010
3015
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3075
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3095
3100
3105
3110
3115
3120
3125
3130
3135
3140
3145
3150

3155
3160
3165
3170
3175
3180
3185
3190
3195
3200

PLEASE SPECIFY YOUR SECOND CHOICE IN CASE WE DO NOT HAVE FREQUENCY ORDERED.

JAN CRYSTALS

2400 Crystal Drive, Fort Myers, Florida 813-WE 6-2397

JAN CRYSTALS

LOW FREQUENCY CRYSTALS in HC6/U HOLDERS

Available in following KC:

116.0 KC
131.104
166.66
190.40
200.0
201.8
204.0
205.66
210.0
226.0
236.0
244.0
252.0
256.0
260.0
259.5
268.0
276.0
281.0
284.0
292.0
300.0
308.0
310.0
316.0
324.0
327.788
332.0
332.8
340.0
348.0
356.0
364.0
372.0
380.0
388.0
396.0
404.0
405.0
412.0
420.0
425.7
428.0
443.0
453.65
462.45
500.0
516.667
*773.958
*816.667
*831.250
*832.292
*859.375

*DENOTES .093 PINS

$1.75 EACH

3 for $5.00

VERY LOW FREQUENCY CRYSTALS in HC13/U HOLDERS

To operate in series resonance oscillators

ALL FREQ. $4.00 EA.

Available in following KC:

9.60
16.0
17.0
19.380
20.40
25.160
25.60
26.0
31.104
32.50
32.90
34.133
38.0
38.40
40.0
62.0
80.0
83.33
86.957
96.0

UNCONDITIONALLY GUARANTEED

SPECIAL CRYSTALS IN STOCK

$3.50 EACH
1000 KC FREQ.
STANDARD IN
HC6/U HOLDER
NEW MANUFACTURE

$4.50 EACH
100 KC
FREQUENCY
STANDARD
HC13/U HOLDER
NEW MANUFACTURE

$1.75 EACH
200 KC
FT-241 Crystal
fits FT-243 Socket

$2.50 EACH
GLASS
80.86 KC
OCTAL BASE
USED IN APQ-13

MINIATURE CRYSTALS

Available in following Frequencies

HC18/U
Pin Type
$1.55 EA.
4 for $5.00

FUNDAMENTAL
FREQ. IN KC
3800
4207
4258.5
4293
9750
11.300

OVERTONE
FREQ. IN MC
38.6500
43.2430
48.7666
52.1666
56.5000
57.5940
58.2940
58.3940
103.9547
104.2547
104.5547
104.7547
104.9547

Chan. No.	Trans. Crystal
1	26965
2	26975
3	26985
4	27005
5	27015
6	27025
7	27035
8	27055
9	27065
10	27075
11	27085
12	27105
13	27115
14	27125
15	27135
16	27155
17	27165
18	27175
19	27185
20	27205
21	27215
22	27225

'CB' CRYSTALS

$1.75 EACH

3 for $5.00

CB CRYSTALS LISTED ARE IN STOCK FOR IMMEDIATE DELIVERY ARE MADE FOR THE SETS LISTED. ALL ARE MINIATURE WITH PINS. FULLY GUARANTEED. WE HAVE TRANSMITTING CRYSTALS ONLY.

ORDER BY CHANNEL NUMBER

TRANSMIT CRYSTALS

Min. Pins, HC18/P
Cadre 75-510-510A-515
Johnson 111
Minifone
Osborne 300-300A
Tokai 100-TC 912
Toshiba ZS 2161A
Cadre 100-500-501
Channel Master
Fanon 1028
Futura
Globe Packetfone
Iwata CT100
Kaltner HT2-500
Knight C-100
Magnavox WT 101
Monarch TC 900B-TR10
Osborn 100-110-120-130
RCA CBR1A5
Sonar COM, CBP
Starlite ST400
Stoner
Trans Com TE11
Truetone

HOW TO ORDER...

Order your crystals by type and frequency . . . enclose check or money order (No C.O.D.) . . . add 5¢ per crystal for postage, 10¢ per crystal for airmail . . . make check or money order payable to JAN CRYSTALS, 2400 Crystal Drive, Fort Myers, Florida.

PHONE AREA 813 WE 6-2397

SEND US YOUR REQUIREMENTS . . . WE ARE RECEIVING NEW FREQUENCIES WEEKLY . . . WRITE FOR LISTINGS

★ **QUALITY CRYSTALS**

JAN CRYSTALS

DIVISION OF BOB
WHAN & SON
ELECTRONICS, INC.

JAN CRYSTALS

2400 Crystal Drive, Fort Myers, Florida 813-WE 6-2397

JAN CRYSTALS

THIRD OVERTONE CRYSTALS — HC6/U HOLDERS

$1.50 EA.

4 for $5.00

The CR23/U is a third or fifth overtone crystal designed to operate in a series overtone circuit, 3rd overtone from 10 to 52 MC, 5th overtone 52 to 75 MC, .005% tolerance, from −55° to +90° C. Maximum drive 5 milowatts. Listing in MC.

IN STOCK FOR
IMMEDIATE
DELIVERY

THIRD
OVERTONE
IN MCS

10.2061
11.2812
11.3062
11.3562
11.3812
11.4062
11.4312
11.4562
11.4812
11.5312
11.5812
11.6062
11.6562
11.6812
12.4770
15.3250
15.4350
15.5060
16.3060
16.9999
16.8250
17.0060
17.2550
17.5060
17.8550
18.4350
18.9350
19.0060
19.3000
19.6833
19.7500
19.8500
19.9500
19.9999
20.0060
20.1166
20.3166
20.4166
20.4350
20.5333
20.5555
20.6166
20.7000
20.7030
20.7535
20.7777
20.8030
20.8333
20.9030
20.9033
20.9350
20.9778
21.0000

21.0300
21.4030
21.4357
21.4888
21.5777
21.6033
21.8000
21.9999
22.1500
22.1555
22.2000
22.3111
22.9999
23.1111
23.3111
23.3333
23.5777
23.8250
23.8333
23.8888
23.9999
24.0060
24.0333
24.1555
24.2000
24.5555
24.7533
24.9111
24.9222
24.9888
24.9999
25.2667
25.4222
25.5333
25.5777
25.6444
25.6920
25.7000
25.7111
25.9888
25.9999
26.1388
26.1625
26.2200
26.2561
26.5333
26.6000
26.6666
26.7037
26.7000
26.7500
26.8222
26.9999
27.0000
27.0060
27.0333
27.0444

27.1200
27.1580
27.2200
27.2550
27.3194
27.4550
27.6041
27.6291
27.6666
27.7000
27.7600
27.7250
27.7777
27.9450
28.5555
28.6200
28.7000
28.7250
28.7500
28.8650
28.8888
28.9222
28.9750
29.0000
29.2250
29.3500
29.6250
29.7000
29.7250
29.8000
29.8750
29.9500
30.0000
30.0667
30.1333
30.1750
30.3250
30.4250
30.6444
30.6888
30.7000
30.7250
30.8222
30.8666
30.8750
30.9250
30.9555
31.0250
31.0000
31.1111
31.1333
31.5888
31.6666
31.6750
31.7000
31.8888
32.0000

32.2000
32.7000
32.8222
33.0622
33.1000
33.1777
33.1950
33.3334
33.4444
33.4496
33.7000
33.8000
33.9000
33.9500
34.4000
34.0500
34.1000
34.1500
34.2000
34.2200
34.2444
34.3500
34.4000
34.4444
34.4888
34.5111
34.5500
34.5555
34.5888
34.6222
34.6500
34.6888
34.7000
34.7222
34.8333
34.8666
34.8888
34.9222
35.0000
35.0444
35.2050
35.5111
35.5555
35.5779
35.6296
35.7037
35.7407
35.7777
35.8148
35.8518
35.8888
35.9259
35.9333
35.9629
35.9777
36.0000
36.0370

36.0740
36.1111
36.1481
36.1851
36.2222
36.2592
36.2963
36.3333
36.3703
36.4076
36.4444
36.4814
36.5185
36.5555
36.5925
36.6296
36.6667
36.7037
36.7407
36.7777
36.7791
36.8148
36.8518
36.8625
36.8889
36.8950
36.9300
36.9259
36.9629
37.0000
37.0370
37.0740
37.1111
37.1481
37.1851
37.2000
37.2222
37.2596
37.2660
37.2963
37.3333
37.3703
37.3777
37.4076
37.4444
37.4814
37.5000
37.5185
37.5555
37.5925
37.6275
37.6296
37.6958
37.6666
37.7037
37.7222
37.7407

37.7777
37.8148
37.8500
37.8518
37.8888
37.9111
37.9259
37.9777
38.0000
38.1666
38.4493
38.8500
38.8889
39.0000
39.5555
39.5185
39.5920
39.5925
39.6666
39.7037
39.7407
39.7777
39.8148
39.8500
39.8518
39.8888
39.9250
40.0000
40.1111
40.1481
40.1850
40.2222
40.2590
40.2962
40.3553
40.4444
40.4814
40.5185
40.5555
40.6667
40.5925
40.6296
40.7030
40.7407
40.7778
40.8148
40.8500
40.8518
40.8888
40.9259
40.9620
41.0370
41.1666
41.3333
41.6667
41.6875
41.7916

41.8500
41.9231
42.0000
42.3333
42.3750
42.4583
42.5925
42.6296
42.6666
42.7000
42.7037
42.7407
42.7777
42.8148
42.8500
42.8518
42.8888
42.9000
42.9166
42.9231
42.9259
42.9629
43.0000
43.2222
43.0370
43.1481
43.1111
43.1851
43.2222
43.2592
43.2963
43.3333
43.3703
43.4074
43.4444
43.4814
43.5185
43.5555
43.5925
43.6296
43.6667
43.7000
43.7037
43.7407
43.7500
43.7777
43.8148
43.8500
43.8518
43.8888
43.9000
43.9259
43.9629
44.0000
44.0370
44.0740
44.1111
44.1481
44.1851
44.2222
44.2592
44.2750

44.2963
44.3000
44.3333
44.3703
44.4074
44.4444
44.4814
44.5000
44.5185
44.5555
44.5925
44.6296
44.6666
44.7000
44.7037
44.7407
44.7600
44.7777
44.8148
44.8500
44.8518
44.8888
44.9259
45.0000
45.2750
45.4184
45.7000
45.7500
45.8830
45.8500
46.1000
46.2500
46.2750
46.3000
46.7000
46.8125
46.8500
46.8958
46.9000
47.0625
47.1875
47.3000
47.3125
47.4375
47.6625
47.7000
47.8125
47.8145
47.8875
47.8500
47.9000
47.9270
47.9375
48.0625
48.1875
48.2750
48.2916
48.3000
48.4166
48.5000
48.6250
48.7000

48.7916
48.8500
48.9580
49.0833
49.1000
49.2083
49.2333
49.2916
49.3000
49.4250
49.6111
49.7000
49.7083
49.7300
49.7916
49.8333
49.8500
49.8750
49.8888
49.9000
49.9060
49.9833

FIFTH
OVERTONE
52.0000
52.2000
42.8333
52.8500
52.9100
53.5000
53.8500
53.9444
54.5500
54.6500
55.0000
55.2750
56.2750
56.9187
57.2750
59.4440
60.6000
60.8330
62.2220
62.8250
64.0000
70.6000
70.6670
71.0000
73.7833
75.0000
80.0000

81.4580
42.3333
82.8333
83.1250
83.3333
90.0000

JAN
MC
CRYSTALS

FT-243 AMATEUR BAND CRYSTALS

$1.50 EACH

4 for $5.00

3520
3530
3560
3550
3560
3570
3580
3590
3600
3610
3620
3630
3640
3650
3660
3680
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3800
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3852
3870
3880
3885
3890
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3930
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3950
3960
3970
3980
3990
3993
7018
7025
7025
7030
7030
7055
7070
7090
7100
7106
7125
7136
7150

7152
TO
7198
EVERY
ONE KC

7200
7203
7206
7225
7250
7260
7250
7270
7275
7278
7280
8000
8010
8020
8025
8030
8035
8036
8040
8041
8043
8047
8050
8058
8065
8070
8075
8077
8080
8082
8084
8100
8105
8110
8111
8116
8125
8126
8138
8143
8148
8150
8154
8160
8164

8166
8170
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8227
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8240
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8250
8256
8258
8260
8266
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8270
8272
8273
8275
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8285
8290
8291
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8300
8301
8306
8308
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8317
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8330
8333
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8341
8350
8357
8361
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8375
8380
8385
8387
8390
8391
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8405
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8434
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8441
8449
8450
8456
8458
8460
8463
8464
8465
8466
8470
8475
8480
8481
8483
8486
8490
8491
8494
8497
8500

PRESSURE TYPE CRYSTALS

JAN
MC
CRYSTALS

75c TYPE 243 EACH

3 for $2.00

Type FT-243. A most rugged type having .093 pins and .486 pin spacing (½"). Designed to operate on frequency in 32 mmfd oscillator circuit. The quartz crystal in this holder is either .5" x .5" or .5" x .6" and is held between two stainless steel electrodes by spring pressure. It is by far the most popular crystal of its type in use.

The following frequencies are in stock for immediate delivery, frequencies guaranteed ±1 KC as listed in kilocycles.

3202
3210
3215
3225
3235
3240
3250
3270
3310
3362
3400
3410
3430
3440
3450
3470
3490
4045
4070
4090
4095
4110
4175
4200
4215
4220
4229
4243
4255
4280

4283
4290
4295
4300
4310
4340
4387
4395
4397
4405
4410
4445
4450
4481
4490
4520
4535
4540
4558
4580
4597
4610
4620
4695
4726
4735
4760
4775
4780
4785
4795
4840
4850
4852
4880
4890
4930
4950
4960
4977
4980
4985
5000
5030
5035
5080
5090
5130
5165
5180
5205

5230
5235
5240
5245
5250
5260
5270
5281
5285
5290
5295
5300
5305
5310
5327
5330
5335
5350
5383
5397
5400
5410
5435
5437
5460
5480
5483
5500
5525
5540
5545
5570
5582
5590
5622
5635
5645
5650
5655
5660
5675
5677
5687
5690
5700
5706
5725
5730
5733
5740
5750

5765
5773
5775
5780
5782
5800
5806
5820
5825
5835
5840
5841
5850
5852
5860
5873
5875
5880
5892
5900
5906
5907
5910
5912
5925
5940
5950
5955
5960
5973
5975
5990
6000
6006
6015
6025
6040
6042
6045
6050
6073
6075
6100
6106
6125
6140
6142
6150
6173
6175
6180

6185
6200
6206
6235
6240
6250
6273
6275
6300
6302
6306
6315
6325
6340
6350
6373
6375
6388
6400
6405
6406
6425
6440
6450
6470
6473
6475
6485
6500
6506
6516
6525
6530
6538
6540
6541
6550
6573
6575
6600
6606
6610
6622
6625
6631
6640
6650
6673
6675
6694
6700

6706
6708
6725
6730
6740
6750
6760
6773
6775
6790
6800
6806
6810
6815
6820
6825
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6850
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6870
6873
6875
6890
6900
6906
6907
6910
6925
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6940
6950
6973
6975
7000
7001
7300
7306
7308
7314
7316
7320
7325
7326
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7333
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7350
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7370
7373

7375
7381
7390
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7400
7405
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7413
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7458
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7466
7473
7475
7480
7486
7491
7500
7503
7505
7506
7508
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7573
7575
7580
7583
7590

7591
7600
7606
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7641
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7658
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7891
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7953
7958
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8000
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8666
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8675
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8683
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8691
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8708
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8741
8797
8820
8833
8977

9067
9090
9112
9135
9175
9720

JAN
MC
CRYSTALS

JAN
CRYSTALS

JAN
MC
CRYSTALS

40-meter general	7000 to 7300	fundamental	7000-7300
40-meter novice	7151 to 7199	fundamental	7151-7199
20-meter general	14,000 to 14,350	double	7000-7175
20-meter general	14,000 to 14,350	triple	4667-4780
15-meter general	21,000 to 21,450	triple	7000-7150
15-meter novice	21,100 to 21,250	triple	7034-7082
10-meter general	28,000 to 29,700	X4	7000-7425
6-meter gen. & tech.	50 MC to 54 MC	X6	8334-8900
2-meter general	144 MC to 148 MC	X18	8001-8221
2-meter novice	145 MC to 147 MC	X18	8056-8166

PLEASE SPECIFY SECOND CHOICE IN CASE WE DO NOT HAVE CRYSTAL ORDERED

JAN CRYSTALS

2400 Crystal Drive, Fort Myers, Florida 813-WE 6-2397

JAN CRYSTALS

Low Frequency Crystals

2 CRYSTALS FIT STD. OCTAL SOCKET
PIN SPACING .486 PIN DIA. .093

370KC to 540KC in FT241 Holders

FT 241

FOR LATTICE NETWORKS — SINGLE SIDE BAND — LOW FREQUENCY OSCILLATORS — MARKERS — ETC. All crystals listed are fundamental frequencies in Kilocycles. Channels 0 to 79 and channels 270 to 289 comprise sets of 80 and 120 crystals.

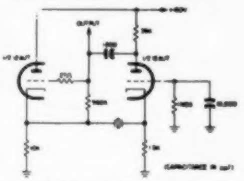
ORDER BY CHANNEL NUMBER AND FREQUENCY

75c EACH
3 for $2.00

ADD 5¢ EA. CRYSTAL FOR HANDLING
10c FOR AIR MAIL

Nominal Crystal Freq. KC	Channel No.
370.370	0
372.222	1
374.074	2
375.000	270
375.926	3
376.388	271
377.777	272
377.778	4
379.166	273
379.630	5
380.555	274
381.481	6
381.944	275
383.333	7
383.333	276
384.722	277
385.185	8
386.111	278
387.037	9
387.500	279
388.888	280
388.889	10
390.277	281
390.741	11
391.666	282
392.593	.12
393.055	283
394.444	13
394.444	284
395.833	285
396.296	14
397.222	286
398.148	15
398.611	287
400.000	16
400.000	288
401.388	289
401.852	17
402.777	290
403.704	18
404.166	291
405.555	292
405.556	19
406.944	293
407.407	20
408.333	294
409.259	21
409.722	295
411.111	22
411.111	296
412.500	297
412.963	23
413.888	298
414.815	24
415.277	299
416.666	300
416.667	25
418.055	301
418.519	26
419.444	302
420.370	27
420.833	303
422.222	28
422.222	304
423.611	305
424.074	29
425.000	306
425.926	30
426.388	307
427.777	308
427.778	31
429.166	309
429.630	32
430.555	310
431.481	33
431.944	311
433.333	34
433.333	312
434.722	313
435.037	35
436.111	314
437.037	36
437.500	315
438.888	316
438.889	37
440.277	317
440.741	38
441.666	318
442.593	39
443.055	319
444.444	40
444.444	320
445.833	321
446.296	41
447.222	322
448.148	42
448.611	323
450.000	43
450.000	324
451.388	325
451.852	44
452.777	326
453.704	45
454.166	327
456.944	329
457.407	47
458.333	330
459.259	48
459.722	331
461.111	49
461.111	332
462.500	333
462.963	50
463.888	334
464.815	51
465.277	335
466.666	336
466.667	52
468.055	337
468.519	53
469.444	338
470.370	54
470.833	339
472.222	55
472.222	340
473.611	341
474.074	56
475.000	342
475.926	57
476.388	343
477.777	344
477.778	58
479.166	345
479.630	59
480.555	346
481.481	60
481.944	347
483.333	61
483.333	348
484.722	349
485.185	62
486.111	350
487.037	63
487.500	351
488.888	352
488.889	64
490.277	353
490.741	65
491.666	354
492.593	66
493.055	355
494.444	67
494.444	356
495.833	357
496.296	68
497.222	358
498.148	69
498.611	359
501.388	361
501.852	71
502.777	362
503.704	72
504.166	363
505.555	364
505.556	73
506.944	365
507.407	74
508.333	366
509.259	75
509.722	367
511.111	76
511.111	368
512.500	369
512.963	77
513.888	370
514.815	78
515.277	371
516.666	372
516.667	79
518.055	373
519.444	374
520.833	375
522.222	376
523.611	377
525.000	378
526.388	379
527.777	380
529.166	381
530.555	382
531.944	383
533.333	384
534.722	385
536.111	386
537.500	387
538.888	388
540.277	389

LOW FREQUENCY OSCILLATOR



80 TO 800 KC

★

QUALITY CRYSTALS
For Every Purpose
In Stock For
Immediate Delivery
24-HOUR SERVICE

ALL CRYSTALS ABOVE WERE MANUFACTURED FOR THE GOVERNMENT AND ARE UNUSED, TESTED AND FULLY GUARANTEED

CR1A/AR
Pressure type crystal used in SCR-522, etc.

75c EACH
3 for $2.00

The following frequencies are in stock for immediate delivery, frequencies guaranteed ±1 KC as listed in kilocycles.

5620
5645
5646
5710
5835
6160
6240
6250
6260
6440
6460
6510
6511
6520
6522.2
6527.7
6541
6605
6611
6633
6641
6666
6727
6680
6860
7033
7038
7083
7210
7372
7466
7488
7516
7520
7540
7565
7570
7580
7695
7705
7850
7860
7910
8000
8001
8002
8006
8007
8008
8030
8037
8046
8050
8065
8086
8092
8114
8133.3
8146
8154
8162
8185
8198
8200
8209
8225
8228
8236
8262
8264
8269
8270
8273
8284
8285
8301
8306
8307
8315
8310
8320
8328
8344
8345
8353
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8431
8435
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8449
8452
8462
8464
8465
8477
8486
8494
8550
8570
8580
8645
8650
8660

PRESSURE-TYPE CRYSTALS

Made to Order

JAN
KC
CRYSTALS

TYPE 243

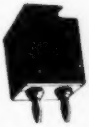
$2.00 EACH
All Crystals .005% tolerance

Available in all frequencies from 2000KC to 8650KC

MC7 CRYSTALS

$2.00 EACH

⅛" pins, ¾" pin spacing, available in 2182, 2638, 2003, 4755 KC and all marine frequencies.



FT-171
For BC-610, etc.

$2.00 EACH

Available in all frequencies from 2000KC to 5000KC.

CR1A/AR
Pressure type crystal used in SCR-522, etc.

$2.00 EACH

All frequencies from 4000KC to 8650KC available with ½" pin spacing and ⅛" pin diam. Specify frequency desired.

HOW TO ORDER...

Order your crystals by type and frequency . . . enclose check or money order (No C.O.D.) . . . add 5¢ per crystal for postage, 10¢ per crystal for airmail . . . make check or money order payable to JAN CRYSTALS, 2400 Crystal Drive, Fort Myers, Florida.

PHONE AREA 813 WE 6-2397

JAN
CRYSTALS

JAN CRYSTALS

2400 Crystal Drive, Fort Myers, Florida 813-WE 6-2397

JAN CRYSTALS

SUB-MINIATURE CRYSTALS IN HC-18/U TYPE HOLDERS MOUNTED ON A WAFER SWITCH ASSEMBLY. HIGH QUALITY CLOSE TOLERANCE CRYSTALS. MANUFACTURED FOR AVIATION TRANSCEIVER USE. ALL CRYSTALS MOUNTED ON A PRINTED CIRCUIT COMPACT SWITCHABLE UNIT. ALL CRYSTAL FREQUENCIES LISTED IN MEGACYCLES.

CRYSTAL WAFER ASSEMBLY # 1

88.00
89.00
90.00
91.00
92.00
93.00
94.00
95.00
96.00
97.00
98.00
99.00
100.00
101.00
102.00
103.00
104.00
105.00
106.00
107.00
108.00
109.00
110.00
111.00
112.00
113.00
114.00
115.00

28 crystals - $ 35.00

CRYSTAL WAFER ASSEMBLY # 2

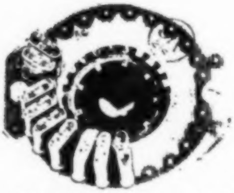
88.00
89.00
90.00
91.00
92.00
93.00
94.00
95.00
96.00
97.00
98.00
99.00
100.00
101.00
102.00
103.00
104.00
105.00
106.00

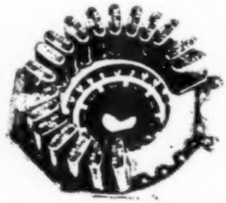
19 - $ 25.00

CRYSTAL WAFER ASSEMBLY # 3

82.00
83.00
84.00
85.00
86.00
87.00
88.00
89.00
90.00
91.00
92.00
93.00
94.00
95.00
96.00
97.00
98.00
99.00

18 - $ 24.00





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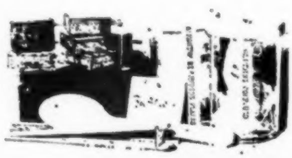

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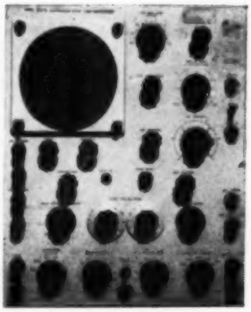

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PRICE .... $16.95 each

COAX CABLE RG59A/U

50 ft. roll complete with coax fittings.
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TRANSISTORIZED MOBILE POWER SUPPLY

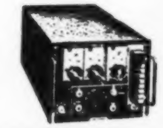
All brand new, factory closeouts. Order now while the supply lasts.
$14.95 each for any model

INPUT	OUTPUT
6 vdc @ 4 A	150 vdc @ 130 ma
6 vdc @ 4.25 A	300 vdc @ 65 ma
12 vdc @ 4 A	300 vdc @ 130 ma
12 vdc @ 4.2 A	400 vdc @ 100 ma

All models same size: 1¾ x 4¾ x 3¼".

AN/ARC-1 TRANSCEIVER

100-156 mc. FB for two meters. Good condition. $24.95



AN/ART-13 TRANSMITTER

2-18 mc. 100 watts AM-CW. Excl. cond. $39.95

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All new manufacture.

T-17D carbon mike with PL-68 plug.	$9.95
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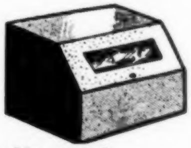
LATE MODEL 14FRXD TD AND REPERFERATOR COMBO



Features sync motor, creep head TD. See February 1964 CQ for more details. This unit replaces the older type TD model 14 repreferator and it saves space. Ex. cond. Non-typing. Not tested. $75.00

Add $25 for overhauled and guaranteed units.

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New • FULLY GUARANTEED • NEW

3B28	$ 2.95	4CX250B	$19.95
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SCR-522 AC POWER SUPPLY

RA-62 rectifier power supply for the popular SCR-522 two meter transceiver. Supplies all necessary voltages. Input 110 vac/60cy/1 ph. Excl. cond. $19.95

COLLINS R-105/ARR-15 RECEIVERS

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AN/CRC-7 two meter walkie talkie. Easy to convert. Excl. cond. .... $ 9.95

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FM FM FM FM FM

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150 MC MOTOROLA BASE STATION 60 WATTS OUTPUT. Sensicon A receiver in desk top case. 115V AC supply. Quantity limited, one unit to a customer. Waiver required. Less microphone and clock. Shipping weight—100 lbs. **$175.00**

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MOTOROLA CHASSIS

60 WATT OUTPUT BASE STATION TRANSMITTER STRIPS. 829B final.

30-50 MC chassis #P8635	**$20.00**
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(115V AC power supply for this chassis listed below)

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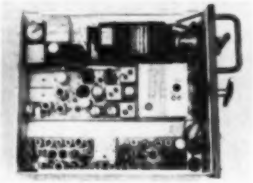
30-50 MC chassis #PA8634	**$15.00**
150 MC chassis #PA8461	**$15.00**
150 MC 10 WATT UNICHANNEL STRIP TRANSMITTER. CHASSIS #P9020C	**$6.00**

450 MC 18 WATT TRANSMITTER STRIP. CHASSIS #TU204 $25.00

RECEIVER STRIP. Lo band Sensicon A base station receiver strip. Chassis #PA8633. Clean units. **$35.00**

POWER SUPPLY. 115V AC. YES, MAN, YES!!! Chassis #P8464, 60 watt base station power supply. Furnishes all B+ and filament power for 60 watt transmitter and Sensicon receiver. Used with 60 watt transmitter strips listed above. **$85.00**



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MOTOROLA T44A-6. 450 MC, 6/12V, DC, 18 watt transmitter. Sensicon receiver, with case. **$54.50**

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Remote amplifier chassis from #8270 remote. In sad shape.	**$ 9.95**
Remote amplifier chassis from FSC-1 Deluxe Remote. Fair condition.	**$15.00**
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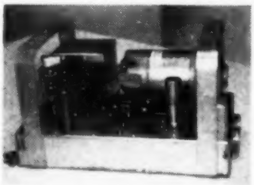
Power supply TU-136 used in T44A-6 mobile.	**$ 9.95**
Power Supply???????? Motorola T41 or T51. Dual vibrator, 30 watts or 60 watts. (I don't know which). Lots of parts and rectifiers. Vibrators included.	**$ 9.95**



GE mobile transmitter—30 watt transmitter. 807 final. 12V DC. **$ 9.95**

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2E26	2.00	12AT7	.40	5842	5.00
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PS 6. Grid bias supply. 2 scale, 0-5 and 0-25 vdc. Metered **$7.95**

6 VOLT RADIART VIBRAPACK
SUPPLIES 300 V DC, 90 MA

Radiart 6821A (RCA MI-8391A) used to mobilize AR-77 & AR-88 rcvrs. Input 6 to 8.5v dc as selected by a 4-position switch to xfrmr taps. The vibrator is Mallory 634C or Radiart VN-10 or any 4-pin non-synch replacement. At full load, the pack draws 12 amps. A 15A fuse is in the battery cord furnished. An OZ4 tube rectifies. Output is altered. New, with instruction book, schematic, & parts list. Shpg wt 12 lbs. Cat. No. 806VP1. Only **$2.95 each 4 for $10**

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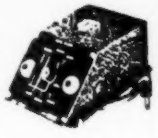

1020 cycles. Same as the FL-8 but more elaborate with cord and PL55 and switching control on slant panel for easy viewing.

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2830 kc if transformers.	$.69
1415 kc if transformers.	$.69
15 mc if transformers.	$.69
190 to 550 kc. RF-ant-etc. (3 can assembly)	$.75

Special BC906—Frequency meter—150 to 235 mc in handy carrying case. 500 microamp meter and National 4" velvet vernier worth for more than the special price of **$7.50** used.

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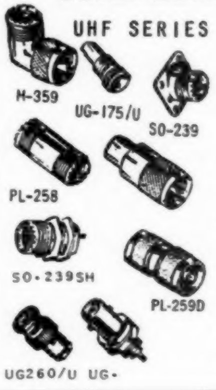

M-359	Used	.25
UG-175	New	.12
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SO-239	New	.35
PL-259	New	.35
Double Male	New	.89
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COLLINS—Single sideband multiplex generator using mechanical filter F84z-2 or similar. With schematic and data. **$22.50**

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SILICON TOP HAT. 600 PIV, 200 ma.	$0.39
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NICKEL CADMIUM BATTERY. Rechargeable thousands of times. Alkaline storage battery sintered plate. Flat voltage curve during discharge. Will hold charge for a long period of time. High discharge rate up to 50 amps. Spill-proof. May be used in any position.

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All are guaranteed. Ask for quantity price.

TUNING FORK FREQUENCY STANDARD. 500 cycle. .001% accuracy. Operates from 24 VDC at .18 A. Removed from new equipment. **$7.50**

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TS-226-2 meter watt or power meter.	New	**$9.95**
TS-667. Convertible to Motorola Test Set. Has 100-0-100 μammeter, etc.	New	**$14.95**

RM-52 Phone patch.	New	**$2.95**
TN-174 Antenna tuner with 244 pf Jennings variable.	New	**$2.95**
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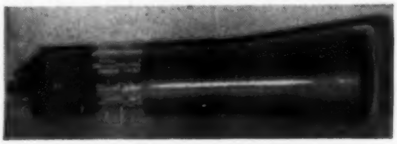
RW SPECIALS



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902A—2 inch face diameter. Filaments 6.3V at 0.6A. Will operate as low as 400V for high voltage and low deflection voltage of 65 to 75V. Fits standard octal socket and is only 7⅝" long. Excellent for Teletype tuning indicators, Modulation monitors, Scopes, etc. Shipping wt. 3 lbs. BRAND NEW **$2.75**

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50KV for VOM or VTVM. Has 500 megohm high voltage deposited carbon sealed resistor. 1"x¼" D tapered brass tip with steel spring wire hook. Clear plastic 1" D body with 5 black insulating discs for high protection against surface leakage. Black plastic handle has threaded end plug; 11¼" O.A. and 3'8" L hi-voltage rubber covered test lead with phone tip plug; plus separate ground lead to alligator clip. Mfgr. Precise Development Corp. for Hickok Elec. Instr. Corp. Lists for $12.00. Brand New **$2.95**

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111 to 123 volts 60 cycles Input. 120 volts 800 MA. output. Used, good condition. **$8.95**

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125 to 20,000 KC. MODULATED Complete with Tubes, Crystal, Original Calibration Book, & 110 volts 60 cycles power supply (RA-133). Like New condition. **$125.00**

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1.5 to 12 mc. Complete with 115vAC 60 cycles power supply, control box, 12vDC dynamotor power supply, and Technical manual. Mfg. by Collins. Used good. **$125.00**

50 Assorted Crystals. A steal at **$6.50**

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88-108 Mfd. 110vAC	5/$1.00
200-200 Mfd. 25vDC	5/75¢
1000-1000 Mfd. 30vDC	5/$1.25
6 Mfd. 1000vDC Oil	$1.00
8 Mfd. 600vDC Oil	$1.00

PE-140 POWER SUPPLY

Output 500vDC at 270MA and two 6.3vAC SEC at 3A each. Input 110/130v, 60cy. Dual choke filter with oil capacitors. Comes with 5Z3 and removable perforated metal protective cover. Size with cover 10¼"x12½"x10½" H. Shipping weight 55 lbs. Used, Good **$14.95**

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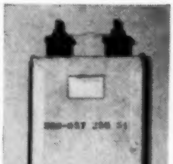

Westinghouse 25MFD capacitor for Kilo-Watt power supply; Rated at 2500vDC, Will handle 4000vDC at 1 AMP and up to 5000vDC at less than 1 AMP in an emergency. This capacitor is filled with .7 gallons of Inerteen oil (NOT Regular Transformer Oil) and is 14" H X 8" W X 4" D overall, with heavy gauge Mounting Brackets. Ship Wt. 32 lbs. NEW **$13.95**

TRANSMITTING VARIABLE CAPACITOR—JOHNSON

Type 500B90, 40-500mmf, 37 aluminum plates with rounded edges, and 0.25" air gap. Cast aluminum end brackets with glass bonded mica insulators. Shaft ⅜"x⅝" L. Size 15¼"x6⅞"x4⅜" H. Shipping weight 14 lbs. Brand new. **$6.95**

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Assortment of:

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BC-342N RECEIVER

1.5 to 18 MC in six bands. Antenna alignment control, Fast & slow tuning knobs, BFO control, AVC & MVC, two RF ampliers, & three 470 KC IF stages. 115vAC 60 cycles. Like NEW. **$69.50**

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475 to 900 MC tuned line osc. assembly, with piston type attenuator. Less 6AF4 tube & shields. Removed from new test equipment. TLO-1, 79¢ each

Scope foundation unit: Removed from new equipment. Channel strip with CRT socket, focus & intensity controls, 2 position controls, 5UP1 scope tube, voltage divider string for CRT, bakelite bezel for CRT and circuit diagram & instructions.
Very limited quan. Only $19.95 per set. (express)

R.F. Sweep generator assembly—removed from TV-FM sweep signal generator. Contains a 6J6 tube, dual variable condenser, mechanical sweep (spkr type) motor and other small parts. W/diagram 60-120 Mc. Only 10 units in stock. $12.50 each

V-R regulated power supply. 110 volt 60 cy input. 105 V.D.C. regulated at 50 Ma & 6.3 V AC @ 1 amp. With diagram: Removed from new equipment. Less the tubes. Each $1.99, 10 for $17.50, Cat # PSC-2

PP-111/APS10 400 cycle radar power supply. Shock mounted chassis. Used & less tubes. Wt. 22 pounds, so should be truck shipment. Each $1.95

2.5 KW RF heater with tubes. Use for parts only as it radiates: USED. Crated for shipment $99.50. You pick up this location for $65.00 (1 unit only)

99¢ PER KIT OF PARTS (please use number)
2 pounds misc. electronics hardware HWD-1
½ pound misc. brass (plated) spacers SP-1
10 Misc. bathtub & oil filled condensers BT-10
5 over 20 watt resistors. Misc. values Res-5
3 pounds cut & stripped hook up wire CW-1
250 ft. (approx) hook up wire (10 rolls) HW-1
20 old type radio & instrument controls Cont-20
3 Misc. relays: may be telephone, etc.: RL-1

49¢ PART KITS: EACH KIT CONTAINED IN AN ALUMINUM COIL SHIELD: 16 to choose from:
A1 (15) precision resistors
A2 (20) ceramic & mica cond.
A3 (10) crystal diodes
A4 (7) low freq. X'tals
A5 (6) controls
A6 (10) power resistors
A7 (15) radio & TV knobs
A8 (20) pilot lamp sockets
A9 (7) X'mitting micas
A10 (14 oz) Hardware
A11 (4) min. Elect.
A12 (10) P.C. tube soc.
A13 (12) screw terminals
A14 (100) solder lugs
A15 (15) Misc. parts
A16 (50) Ins. resistors
Each kit 49¢. Assorted unused parts in each kit.

"BUD" CE-2005 variable condenser: Max cap 150 Uufd. Air gap. .030". Original boxes. Each $2.48
"BUD" CE-2007 variable condenser: Max cap 250 Uufd. Air gap .030". Original boxes. Each $3.24
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"BUD" MC-1876 variable condenser: Max cap 140 Uufd. Many in original cartons. Each $1.29
"NATIONAL" variable condenser: Max cap of 100 Uufd. Straight line frequency type. Each $1.69
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"HAMARLUND" air padder condenser (screw driver slot shaft) 25 or 100 Uufd. Each 49¢ 10/$3.50
Dual section variable condenser: 50 & 100 Uufd sections. Very smooth vernier drive. 2x4x3½" $1.89

"EL MENCO" variable mica trimmer condensers:

302	15-130 Uufd	19¢	310	650-1890 Uufd	40¢
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305	190-750	28¢	312	880-2330	45¢
306	275-970	32¢	315	1400-3055	49¢
307	350-1180	32¢			

"AEROVOX" .03 MFD 2000 DCWV Tubular condenser. Type 2089D. Each 19¢, 10 for $1.50

Donut current transformer: 150/5 A.C. Amp. Use with a 5 Amp. instrument. DCT-1 $2.95 each
FILTER CHOKE: 7 Hy at 150 Ma. D.C. Res 200 ohms. Channel mount type. Factory surplus (700 on hand). Each 89¢, 10 for $7.99, 100 for $69.50

GUARANTEES: Your satisfaction is guaranteed: merchandise may be returned (original condition) for a cost of merchandise refund. (30 day limit)
All parts (new) are guaranteed for 90 days against defects in material or workmanship. Guarantees are void if parts have been misused or overloaded.
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POWER TRANSFORMERS: $1.79 each
All have 110 volt 60 Cycle primary windings:
T-16 175-0-175 volt at 30 Ma. 6.3 volts @ 0.6 Amp. 6.3 volts @ 1 amps.
T-23 315-0-315 volts @ 50 Ma. 6.3 volts @ 0.6 amp. 6.3 volts @ 2 amps.
T-28 325-0-325 volt @ 50 Ma. 6.3 volts @ 0.6 amp. 6.3 volts @ 2.5 amps.
T-40 175-0-175 volt @ 30 Ma. 6.3 volts @ 0.6 amp. 6.3 volts @ 2.4 amps.
T-50 336-0-336 volts @ 75 Ma. 6.3 volts @ 3.1 amp.
T-73 175-0-175 volt @ 75 Ma. 6.3 volts @ 2 amp.
All above transformers are half shell type (NEW), $1.79 each, 3 or more at $1.61 each

5UP1 scope tube. Removed from new equipment. Guaranteed. O.K. (Express shipment) each $6.49
TUBES: UNUSED FROM A FACTORY: OA2 82¢, OA3 99¢, 1G4 76¢, 5R4GY 98¢, 6AF4 98¢ 6C6 59¢, 6C8 $1.09 6D6 59¢, 6F6 $1.09, 6F7G 95¢, 6H6 39¢, 6F5 49¢, 6J5 84¢, 6J7 $1.18, 6J6 48¢ 6K6 61¢, 6Q7 $1.38, 6SA7 99¢, 6SG7 59¢, 6SN7 60¢, 6U5/6G5 99¢ 6Z5 $1.39, 7A5 99¢, 12Z3 49¢, 25Z5 $1.09, 25Z6 73¢, 30 $1.59, 53 $1.99, 76 $1.59, 79 $1.59, 83 $1.49, 84/6Z4 $1.25, 9006 19¢, 80 79¢, 807 $1.62. Some in cartons and some are bulk pack. Guaranteed.

Mica base terminal strip as used in command receivers: TS-2 each 5¢, TS-3 10/35¢ TS-4 100/$2.99
10-32 Threaded rod with test prod on one end. 1⅞" total length. Rod-1, 6 for 48¢
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Solder lugs: clears a ¼" stud as used on meters. Light-duty —hard to find item. SL-1, 50 for 49¢
Solderless terminals—clears a #10 screw. For wire sizes 22 to 16. SL-3 25 for 63¢, SL-4 50/99¢
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Green jewel bayonet (47) panel lamp assembly (less bulb), 22¢ each, 10/$1.75, 100 for $15.00
Shunt: 10 amp 250 Mv. as used in V.O.M., 29¢ each
Selenium Rectifier: 15 Ma 120 RMS volts. As used in V.T.V.M.'s. SL-1 each 18¢, 10 for $1.50
Bliley MC-9 3500 KC crystal each 50¢, 10/$4.90
Lever switch—2 deck 3 pos. Spring return to center. Fine for intercoms: LS-1 each 59¢, 10/$4.99 (less knob)

Lever switch—1 pole 3 pos as used in tube testers. Less knob. LS-2, each 39¢, 10/$2.99
Miniature parts contained on a 2⅝ x 3⅛" printed circuit board: all have transistors & many parts. 2 boards 59¢, 5 boards 99¢, 10 boards $1.95
Ceramic trimmer condensers "ERIE" NPO type 822 1.5-7 (CT-1), 5-20 (CT-2), 4.5-25 (CT-3), 35¢ each
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Oil filled condenser: 5 MFD @ 230 ACV (600 DCV) Approx. 1x2x4". CL-1, each 69¢ 10 for $5.99
24 Cu Ft/min. blower: 27 VDC @ 500 Ma. 2¼x2¼x3½". Fine for tube cooling. Each $1.69, BL-1
2 each 892 tubes, Fil X'formers & water jackets. USED: removed from equipment. All for $100.00
Low inertia motor (AC) with gear train. Used 89¢
7 pin min. tube socket w/shield base (no top shield). Black STB-1, each 9¢, 10/79¢, 100 for $6.99
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Phone plug—2 conductor (¼" Dia. plug) chrome plated shell. Cat. # PL-1, each 52¢. 10 for $4.75
"AMPHENOL" plug and socket. 4 pins plus shell. Plug is shielded, each set 25¢, 10/$1.89
2.5 Mh 100 Ma "NATIONAL" R.F. choke, each 29¢
500 MH RF choke. Should carry 200 Ma. Base 1½" dia x 2¼" long, RFC-2, each 19¢, 10/$1.49
Rubber grommet: mounts in a 1 inch hole: cable hole is ⅝ inch. GRO-1. each 4¢, 10/29¢, 100/$2.49
Coil with shield: slug tuned form ¼" diameter with a 1 inch winding space. Now tunes 79-85 MC. Stud type mounting: CF-1 each 29¢, 10 for $1.99
"IRC" insulated carbon resistors: 10,000 ohms—one half watt. 10% each 6¢, 10/45¢, 100/$1.99

TERMS: Cash (registered), check or money order with order. Enclose enough for postage—all excess will be refunded by check or postage stamps. $3.00 minimum order on cash orders.
Minimum C.O.D. order $10.00 and must have 25% deposit included with the order.
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Most orders are shipped out the same day as received.
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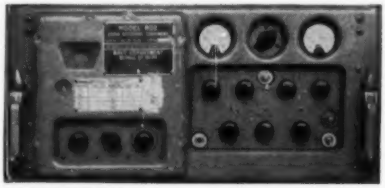

RDZ RECEIVER, 10 channel crystal controlled, 200-400 mc, 115 volt 60 cycle power supply. Navy surplus and made to highest standards. Cost $2,500.00 each. We offer brand new units, original boxed, with antenna, plugs, schematic and crystal figuring data. Shipping wgt 235 lbs. **$125.00**

TRANSISTORS, 1st Grade, branded. Your choice **3/$1.00** or **$3.00 dozen.** All "2N" numbers.

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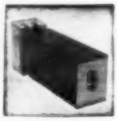
SILICON BI-SWITCH 7 amp 200 piv., used in AC phase control and lamp dimmers. Circuit for 750 watt lamp dimmer included. **2 for $1**

SILICON NPN MICROTRANSISTOR, silicon planar epitaxial. V_{cbo} 40 volts, V_{ceo} 15 volts, 150 mw, 100 mc, with specification sheet. **2 for $1**

SILICON BI-DIRECTIONAL TRANSISTOR. PNP-NPN. 2N1640. **2 for $1**

SILICON MESA POWER TRANSISTOR. 85 watts, 2N424 NPN. **2 for $1**

Experimenter's package. Your choice of any 12 of the above for $5.



Digital Indicator displays figures on translucent window 0-9. Plug-in bank of 6 volt bulbs on rear, each bulb when energized display one digit on the window. **$6.00**

CRYSTALONICS FET (Field Effect Transistor) with spec sheet. See December 73 for more information on FET's. **$1.00 6/$5**

SILICON DIODES SPECIAL

800 PIV 400 ma	**$3.00/12**	**30¢ each**
1000 PIV Studs 2 amp	**$10.00/12**	**$1.00 each**

150 PIV 35 amp. Used, guaranteed, with mounting hardware. **$5.00/6 $1.00 each**

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19 Allerton St., Lynn, Mass.
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SNIPERSCOPE, M-3, late model, permits viewing in total darkness. Ready to use, includes 20,000-volt power supply. You furnish 6 volts DC to operate. Used, checked out. Rifle shown in picture not included. **$225.00**

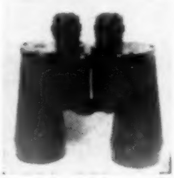
TRANSISTORIZED SOLID STATE power supply. 115 volt AC 60 cycle in. 12 volt DC 8 amp regulated out. **$30.00 each.**

ARN-6 LOOP ANTENNA **$6.00**

BC-733 RECEIVER w/conv sheets for 6 meter receiver. Exlnt. **$8.00**

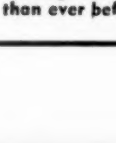
750 MA DIODES, SILICON "SM"

1,000 PIV	**45c ea.—$4.50/12**
800 PIV	**2.00/6**
600 PIV	**1.50/6**
500 PIV	**1.25/6**
400 PIV	**1.00/6**
2 AMP 800 PIV	**75c ea.—7.50/12**



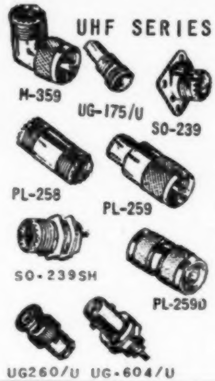
BAUSCH & LOMB NAVY 7 x 50 BINOCULARS. Brand new, coated lens. Individual focus, with case, straps, filters. B and L cost $279.50. Magnificent handheld Navy glass. Waterproof, dustproof. **$95.00**

SYNCHRONOUS CLOCK MOTOR driving a gear train to produce one revolution/8 hours with analog output by means of a precision 10K pot. Reset with another built in 115 V 60 Cycle motor. May be taken apart for the 2 motors, one a precision motor driving a gear train and the second motor 60 cycle induction 115 volt. Unbelievable **$1.50**



ARC-5 TRANSMITTER 7-9 mc. Written up many many times, but try and buy one. Perfect condition in original gov't renew packages, each with individual log and work sheets. This will no doubt be the last of them. **$23.00**

New 1966 catalog hot-off-the-press. We keep no mailing lists. Send 25¢ for the best 80 page catalog we have ever printed. More bargains than ever before.



M-359	**35c**
UG-175	**15c**
UG-176	**15c**
SO-239	**35c**
PL-259	**35c**
PL-259D	**90c**
SO-239SH	**40c**
UG-260	**35c**
UG-604	**35c**
PL-258	**75c**

MAT HI FREQ TRANSISTORS

Micro-Alloy Transistors.
Hi frequency
5 for $1.00

NAVY RBA LOW FREQUENCY RECEIVER

RCA mfg. tunes in four bands from 15-600 kc. Direct reading dial, used by the Navy up to recent date and just being released. Outboard 115 AC 60 cycle power supply with each. Just the thing for you old shipboard sparkies. Also picks up the new long wave Navy stations on 60 kc. **$95.00**

IBM WIRED MEMORY FRAMES

Removed from high priced computors. Exlnt condition.

160 core	**$ 3.00**
1,000 core	**10.00**
4,000 core	**12.50**
8,000 core	**15.00**
16,384 core	**35.00**

MEMORY DRUM w/drive motor, 40 read-write heads **$100.00**

SPECIAL ★ SPECIAL ★ 2 AMP SILICON RECTIFIER, 1,000 PIV **$10 DOZEN**

ANALOG OUTPUT electronic timer. 2 electric motors, one with gear train driving precision pot., the other for re-set. One rev. per 8 hours, output on precision pot. Made for Veeder Root. **$1.50**

RUNNING TIME METER indicates total running time to 9999.99 hours. Use it for time-in-use of motors, oil burners, machines, etc. Operates from 115 volt AC 60 cycle. **$4.50**

CANADIAN AIR FORCE carbon mike noise cancelling, made by Electro Voice. Unused. **$1.25**

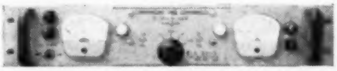
MARINE-POLICE-FIRE CONVERTERS. 3 models 2-3 mc, 30-50 mc, 100-200 mc. Simple to use with any car radio. Build it yourself kit with instructions $5.00 any model. Completely built, ready to use **$15.00** any model.

88 MH TOROIDS. Two types available. Open and potted. Used for many applications such as power supplies and teletype.

Open style **50c** ea., **12/$5.00**
Potted style **65c** ea., **12/$6.00**

TELETYPE PAPER. 8½" wide, single, manila. **$1** per roll. Case of 12 rolls **$10**

POWER SUPPLY KIT, 6-12-24 volts DC 6 amps from 115 volt 60 cycle AC. Easy to build, with transformer. Operate surplus equipment, plating, battery charging, etc. **$12.00**



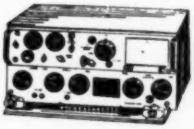
TRANSISTORIZED REGULATED SOLID STATE supply made by LFE. 19 inch rack panel mount. 115 volt 60 cycle input. Output variable 25%. 28 volts DC 500 ma. **$30.00**

CQ's NEW Conversion Book **$3.00.** Pages of surplus Conversions plus 3 articles on ART-13.

11/16" TELETYPE PUNCH TAPE Buy 2, save on shipping. **SPECIAL:** 6 cartons **$25.00** Carton 40 Rolls **$5.00**

AN/ART-13 100-WATT XMTR
2 to 18.1 Mc
11 CHANNELS

$39



Collins Autotune Transmitter, extremely stable and suited for side band. Written up in QST Oct. issue 1953. Used, with tubes.

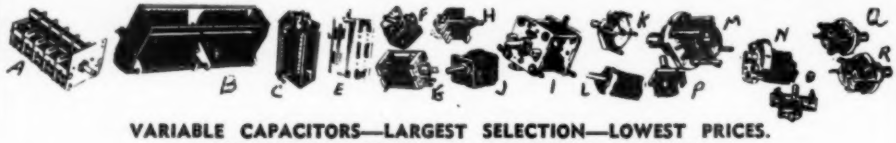
US SNIPERSCOPE, M-3, infra red, ready to use. **$225.00**

SNIPERSCOPE IR CONVERTER tube #6032 w/specs. **$6.50**

MESHNA

19 Allerton St., Lynn, Mass.
All Material F.O.B. Lynn, Mass.

"JUNQUE"—THE CREAM OF MILITARY AND INDUSTRIAL SURPLUS AT SKIM MILK PRICES



VARIABLE CAPACITORS—LARGEST SELECTION—LOWEST PRICES.
A-ASP; B-BUD; C-CARDWELL; E-JOHNSON; M-MILLEN.

A) 5 gang, 402 pf/sec. for output pi-net. Load 160 meter, less inductance. Handle KW. ⅜" shaft.	*$2.50
A) same, with 60:1 rt angle gear drive	*$2.50
B) E#152-516, dual 470 pf/sec. 4½ KV ¼" shaft	$7.00
B) C dual 8-90 pf/sec. 9 KV ⅜ x 2" shaft	$6.00
C) E#154-1, 12-244 pf, 2 KV dual ¼" shaft	$3.50
C) E#154-11, 9-38 pf, 4½ KV dual ¼" shaft	$2.25
C) E#50F30, 9-52 pf, 3 KV dual ¼" shaft	$2.00
C) C or M, 12-151 pf, 3½ KV ¼ x 1" shaft	$3.95
D) C 365 pf, 2 KV ¼ x 1" shaft $1.75	4/$6.50
E) GE 20-175 pf, 3½ KV ¼ x 1" shaft $1.25 ea.	4/$4.75
F) ARC 20-135 pf, 3½ KV ¼ x 1" shaft $1.25 ea.	4/$4.75
F) ARC 10-100 pf, 3½ KV ¼ x 1" shaft $1.25 ea.	4/$4.75
G) M#21140, 140 pf, 600v, silvered, ¼ x 1" shaft	$1.00
G) COMAR#511053, dual 5-15 pf/sec. with coil to tune 140-260 MC. Heavy silver, ¼ x 1" shaft	$1.25
H) B#MC1857, 7-150 pf, 1 KV dual ¼" shaft $1.25	4/$4.75
I) 44 pf, with 6 meter coil, 79¢ each	3/$2.25
J) dual 360 & 140 pf, for BC rec. ¼" shaft	39¢ ea.
K) E#167-302, 4-51 pf differential, ¼" shaft 50¢	3/$1.35
L) APC w/¼ x 1" shaft. 3½-25 pf; or 5-35 pf	69¢ ea.
M) H#52C4417, 3-75 pf, 3/16" slot. shaft, 69¢ ea.	3/$1.95
N) APC slotted ¼" shaft, locking nuts	
100 pf 49¢ ea. 3/$1.35; 50 pf 39¢ ea.	3/$1.10
25 pf 29¢ ea. 4/$1.10; 15 pf 23¢ ea.	5/$1.00
50 pf with 10-11 meter coil 50¢ ea.	3/$1.35
3-15 pf slotted plastic knob 23¢ ea.	5/$1.00
O) 8-12 pf IF trimmer, silvered. 3/16" shaft 23¢ ea.	5/$1.00
P) 3-15 pf ant trim. com rec. ⅛" shaft 19¢ ea.	6/$1.00
Q) E#160-205, 1.8-5.1 butterfly, 3/16" shaft $1.00 ea.	4/$3.75
R) E#160-107, 2.3-14.7; or ASP 1.1-15 pf, 69¢ ea.	4/$2.60
R) #E160-102, 1.5-5; or E#104, 1.8-8.7 pf, 50¢ ea.	4/$1.75

ROTARY, TRANSMIT, RF, IF COILS

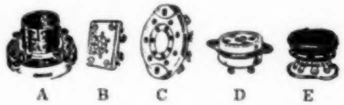
40 uhry, rotary, 18A ribbon, *soiled, dirty,	$5.00
10 or 160 meter, 250w, for HT4. Choice $1.00 each	4/$3.00
85 KC IF, HI-Q, ceramic, for r-11, $1.25 each	3/$3.50
239 KC IF, for BC com. rec. early type 50¢ each	3/$1.35
15 MC, ceramic, for R-18 late type 39¢ each	3/$1.10
Ant. RF & Osc. for BG455, 6-9 MC 50¢ each	3/$1.35
.2-.25 uhry, brass slug, 6 meter 39¢ each	3/$1.00
1 uhry, AIR-DUX, 6 meter, cut in ½ for 2 29¢ each	4/$1.10
OHMITE Z-1, 5½ uhry, 8½ ohm, 1A. 40-120 mc 23¢ each	5/$1.00
2½mhry, 40 ohm, 100 ma, 4 pi, ceramic RFC 39¢ each	3/$1.10
2½mhry, 100 ma, 3 pi, ferrite in bakelite 29¢ each	4/$1.10

METERS

0-3½, or 0-6A. RF.WESTON, 3½" sq. with thermocouple 2% to 65 mc. latest type. Choice	$6.50
0-300, or 0-800 ma DC. 3½" sq. WESTON choice	$5.00
0-100ua DC. scale, 0-.3 ma. 3½" sq. Simpson	$7.50
0-800v DC, 3½" rd. BURLINGTON herm. sealed	$3.50
0-25ma DC, 2½" sq. COLLINS $3.50 each	3/$10.00
0-200ma DC, 2½" sq. COLLINS or TRIPLETT $3.50	3/$10.00
0-3A RF, 2½" sq. SIMPSON $3.50 each	3/$10.00
0-100 ma DC 2½" sq. CANADIAN $3.00 ea	4/$11.00
0-1.2 ma DC, 2½" rd. scale 0-100, wh on blk.	*$2.00

BLOWERS

with 115v. 60 cycle motors. High speed, shaded pole phono motor, with metal fan blade. Quiet, balanced. BRAND NEW	$1.95
100 CFM +, squirrel cage on HEINZE motor, ½A, 3000 RPM. USED, in good, clean operating condition. GUARANTEED.	5.00



TUBE SOCKETS AND ACCESSORIES

A) 4 pin, bayonet, 25w, for 866, 811, etc.	69¢	4/$2.60
A) same * wired in pairs, good, clean	69¢ pr.	4/$2.60
A) 4 pin, 50w for 872A.	$1.25 ea; 4/$4.75	10/$11.50
B) 7 pin, ceramic wafer, for 832, 829	79¢	4/$3.00
D) 5 pin, heavy ceramic, ring & saddle	29¢	4/$1.10
D) 4 pin, heavy ceramic, ring & saddle	29¢	4/$1.10
B) 7 pin ceramic wafer, for 829, *clean	59¢	4/$2.25
C) 7 pin ceramic wafer, for 1625, 837	29¢	4/$1.10
E) 7 pin, tan bake. ring mtd. for 1625	29¢	4/$1.10
E) 11 pin, blk. bake. EBY. for 2AP1, 5BP1	39¢	3/$1.10

All items fully guaranteed, are new, except "*" removed from equipment, usually unused, but in good operating condition. All items are subject to prior sale and all prices are subject to prior sale and all prices are subject to change without notice. Prices are NET, FOB our store in Chicago. For Illinois deliveries, add 4% to prices to cover sales tax. Please include sufficient postage. Any excess refunded with the shipment. All orders, except in emergency or when I'm at a hamfest shipped the day received. Canadian customers. Postage 80@ 1st 2 lbs., 30¢ each additional pound, plus insurance.

HAMFEST SCHEDULE: Starved Rock, Ottowa, Illinois, June 5; Tri-State College, Angola, Illinois, June 12

BC ELECTRONICS

2333 S. MICHIGAN AVENUE, CHICAGO, ILLINOIS 60616 · 312-CA 5-2235

Ceramic wafer, for acorn tubes 19¢	6/$1.00
7 pin ceramic, new 19¢, 6/$1;* good 15¢	7/$1.00
9 pin ceramic, shield base, new 23¢	5/$1.00
9 pin, blk. bake. NEW; or ceramic * 19¢	6/$1.00

STEPPERS—48v DC coil. Take-outs

6 level, 26 position, clean	$7.50
same, discolored, operating	$6.00
3 level, 26 position, clean	$6.00
same, discolored, operating	$4.50

LEFT-OVERS, CLOSE-OUTS

T21/ARC5, 5.3-7 MC transmitter, was $6.50	$6.00
TU7, 4.5-6.2 MC, loaded w/parts, *was $2.95	$2.50
IP274/ALA10, panadapter. 30 MC ±5 MC. 400 cycle power supply. With instructions for 60 cycle solid states power supply; and conversion to 14 MC, if desired. Excel. All tubes. Was $30.	$22.50
RE2/ARC5, antenna relay, less vac. cap.	$1.25
Range Filter. A MUST for RTTY & CW. POOR-MANS' Q 5-er. Has 2 jacks, cord with PL-55; 3 position switch; RANGE passes 1020 cycle; VOICE rejects 1020 cycle; BOTH no filter action. NEW	$1.95
Central Electronics' Q Multiplier kit. Important parts, specially made for this 380 pf and dual 60 & 30 pf variable; 455 KC IF; 20 K pot; and 'Q" coil. With schematic, was $4.00, now	$3.50

ELECTROLYTICS, TANTALUMS, CAPACITORS

25,000 mfd 25v DC SANGAMO, 3" d x 4½"	$3.50
6,000 mfd 75v DC SANGAMO, 3" d x 4½" $3.50	3/$10.00
1,000 mfd 15v DC, 1¼ d x 2¾" 50¢ each	6/$2.75
250 mfd 350v DC 2"d x 3¾"* 79¢ each	3/$2.25
500 mfd 200v DC 2" d x 3¾"* 79¢	3/$2.25
125 mfd 350v DC, twistlock, 1½" d x 3"	$1.25
5000 mfd 35v DC, 2" d x 3" * good 50¢ ea	4/$1.75
80 mfd 450v DC, 1½" d x 3¾". SALE $1.25	4/$4.75
1200 mfd 25v DC, 1¼" d x 4½" 69¢ each	3/$1.95
1000 mfd 15v DC, 1¼" d x 2¾" 50¢ each	6/$2.75
.004 mfd 5KVW, upright mica $2.00 each	4/$7.50
.00275 mfd 2KVW, upright mica $1.50 each	4/$5.75
.01 mfd 2½KVW hex mica $1.25 each	4/$4.75
30 mfd 450v DC ATOM lytic, pigtails, 79¢	4/$3.00
20 mfd 60v DC Tantalum pigtails, 50¢	4/$1.75
175 mfd 15v DC Tantalum pigtails, 50¢	4/$1.75
130 mfd 25v DC, can neg. ½" d, 1¼" pigtails 50¢	4/$1.75
68 mfd 30v DC, can neg. ⅛" d, ⅜" pigtails 39¢	3/$1.10
vacuum capacitors. 50 pf, 5KV* good	$2.50
25 or 50 pf, 10KV choice, NEW	$4.50
50 mfd, 125v DC, ¾" sq x 1", can neg. 2 on assembly. GE. tantalum. 69¢ each	3/$1.95
Type 850 hi volt capacitors. 25, 40, 67 or 100 pf, D KV. choice	$1.00
1500 pf, 600v feed thru* good 23¢	5/$1.00
500 pf, 20KV barrel, $1.00	4/$3.75

TRIMMER CAPACITORS

Assembly on tan bakelite, (5)NPO 5-25; (1) NPO 3-12; (2) N 8-50 pf. $1.25/board	4/$4.75
(5) NPO 1.5-7 pf. 75¢/board	4/$2.75
(4) NPO 5-25 pf. 60¢/board	5/$2.75
7-100 or 10-125 pf, choice 18¢ each	6/$1.00
ARCO 3-30 pf, miniature 18¢ each	6/$1.00
(2) 5-20 pf, on ceramic plate 23¢ each	5/$1.00

PISTON TRIMMERS, by JFD

JMC #1801, ½-12 pf quartz, *69¢	3/$1.95
GW #C48, 1-12 pf, glass.* 39¢	3/$1.10

FLOOR SWEEPING—WASTE BASKET OVERFLOW

First try, only because got a line termination, mixed, from a large mftr, sweetened with left overs odds & ends. NO JUNK. 5 LB. pliofilm bag.	$1.65
5 pounds assorted hardware. All good useable, nuts, screws, washers, etc. NO JUNK. Pliofilm bag	$1.25

CO-AX Connectors, current production to latest mil specs.s WW11 surplus.* take-outs good.

PL-259, SO-239, choice 39¢; 3/$1.10; 12/$4.25
PL-259A s, 29¢, 4/$1.00; M-359 s 49¢ 3/$1.35
PL-258 65¢ ea, 5/$3.00; M-358 T $1.95 5/$9.50
CH-259, chassis male, takes SO-239 95¢, 5/$4.50
DOUBLE MALES, **DO NOT BIND,** fits SO-239 95¢ 5/$4.50
J-102, s, 1 hole SO-239, w/nut. 29¢ each 4/$1.10
UG-175/U, or 176/U, choice, reducers 11¢, 10/$1
UG-21/U 35¢ ea; 3/$1.00; UG/U 69¢ ea 3/$1.95
UG-290/U, 69¢, 3/$1.95;* clean good, 23¢, 5/$1.00
9113T **GOLD,** $1.50; UG909/U, 1 hole, 79¢, 4/$3.00
UG-274B/U BNC T, $1.00; UG692/U 79¢ 4/$3.00
UG535/U, rt angle BNC chassis, teflon,* 39, 3/$1.00

CO-AX CABLE

RG58/U, 52 ohm, new production, 50' $3.00; 100' $5.75
RG-174/U, 50 ohm miniature, for internal wiring. Mike cable, 4' 12¢, 9/$1.00; 50' $1.50; 100' $2.75
RG8/U.w/2 UG21B/U, COLLINS. 16" 49¢; 24" 69¢; 5' $1.00
RG11/U, 72 ohm, w/2 PL-259 s, 12' $1.25; 30' $1.95
RG59/U, 72 ohm, 8' w/1 Motorola phono plug 39¢
RG59/U, w/1 JERROLD TV plug, 59¢ each, 3/$1.65

RELAYS

RE13/ARA8, CO-AX, SPDT, T-R, 100 w to 2 meter. Has 3 SO-239, takes 3 PL-259. In metal box, 3½x3x1¾". Has two coils, in series, for 24v DC, easily rewired for 12 v use. NEW $3.95; w/3 PL-259	$5.00
A) SPDT, T-R, co-ax. Rated 250w to 250 MC, 100w to 10000 MC; SWR @ 1 KMC 1.3:1. ov 25 ohm DC coil. Takes UG88/U & 2 specials. BRAND NEW	$3.00
With 3 BRAND NEW plugs	$5.00
With UG88, 2 7' RG59, with plug one end	$4.50
B) DPST 40A contacts, easily made into DPDT. 12v DC coil. Dynamotor start.* excel. $1.00	4/$3.75
C) SPDT, 3A contacts. 12v 60 cycle coil, NEW	79¢
D) DPDT, 3PST NO, SPST NC, coil 115v 60 cycle	$1.75
E) SPDT, impulse, mechanical latching. A **MUST** for automatic keyers, in RTTY. Pulse sets, next pulse resets (reverses) .24v 60 cycle coil, new	$1.75

ROTARY CERAMIC SWITCHES

All heavy duty, handle KW RF. Heavy duty detents.

3 deck, 8 position, no stop, 5 wired. ¼ shaft	$2.50
2 deck, 6 position, progressively shorting.	$2.50
2 deck, 12 position, non-shorting ¼" shaft	$2.50

ROTARY CERAMIC SWITCHES, with ¼" shafts

Heavy duty, all handle KW RF. Heavy duty detents.

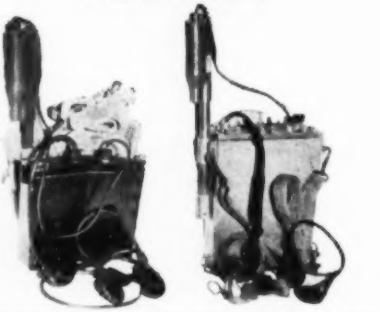
3 deck, 8 position, 5 wired, no stop, progressively shorting	$2.50
2 deck, 12 position, non-shorting	$2.50

BC ELECTRONICS

2333 S. MICHIGAN AVENUE, CHICAGO, ILLINOIS 60616 · 312-CA 5-2235

TELEMARINE CLOSEOUT SPECIALS!

WALKIE-TALKIE



MODEL "MAB" is a Navy Walkie-Talkie which provides single-channel, crystal-controlled reception and transmission (AM) between 2.0 and 4.5 MC. Receiver uses miniature tubes in a **superheterodyne circuit** for maximum sensitivity and selectivity. Transmitter employs miniature tubes in a crystal-controlled oscillator (1T4), a 384 RF Power Amplifier which will deliver from 200 to 250 milliwatts RF power to the antenna (can be souped up), and a 384 Heising (plate) Modulator stage. 7 tubes total in trans-receiver. Unit is housed in a water-tight bakelite case. 7½"H. x 10"W. x 3-9/16"D. RANGE 1 MILE OR BETTER, depending on location and condition. Requires 135 volts "B" and 1½ volts "A" batteries. Excellent for 75 meter Ham, CD, Fire Dep't, emergency marine, or conversion to other uses. Supplied Complete with all tubes, r'c'ving & x'mitting crystals (sorry, we cannot accept orders for a specified frequency. Crystals are FT-243 type, and can be easily changed), telescope antenna with adjustable loading coil, headphones, microphone, and canvas carrying case with straps. In Almost-New condition, but not tested at this price. Shpg. wt. per set 15 lbs.
PER PAIR .... 2 Complete Sets, as above $19.95

MODEL DAV is a Navy Walkie-Talkie, same as above, but with Direction Finding Loop within so that receiver section may be used for D.F. or Homing on the crystal-controlled receiving frequency. Same transmitter as outlined above for Walkie-Talkie use with supplied adjustable telescopic antenna. Encased in water-tight, sturdy plywood case, slightly larger than above. Shpg wt. Complete accessories as MAB, 20 lbs.
EACH, AS NEW—but not tested at this low price $16.95

INSTRUCTION BOOK FOR MAB OR DAV
only with purchase of units $1.00

MINIATURE VIBRATOR PACK FOR MAB OR DAV, eliminates nuisance and expense of dry batteries. Operates from miniature 6 volt storage battery, not supplied, available from many surplus dealers. With Instruction Book. Shpg. wt. 5 lbs. UNUSED.
EACH $7.95

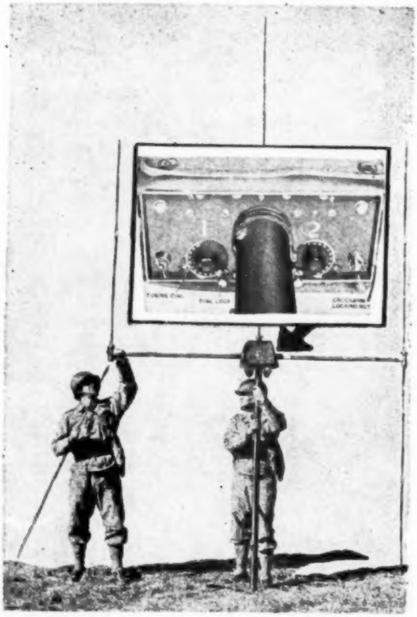
MINIATURE STORAGE "A" & "B" BATTERIES. For Walkie-Talkies, Radio Portables, Radio-Controlled devices, Radio-Sondes, or equivalent meteorological devices. Supplied as a set of 3—"B" batteries of 36 volts each, and 1—"A" battery of 6 volts. Batteries dry-charged, less electrolyte and packed in a hermetically sealed vacuum metal container which prevents possibility of deterioration or loss of efficiency until opened and ready for use. Both "A" battery (BB-51) and "B" battery (BB-52) are ¾" deep x 1½" high x 3½" long, with 2 connection pins of ½" length protruding from each battery. Hypodermic needle required for acid—water filling 1280-1330 specific gravity. Full instructions supplied with each set of batteries for filling and charging. NEW-UNUSED, shipping weight 4 lbs. **PER SET** of 4 batteries as described............................ **$1.95**
3 SETS (4 Batts. each) for $5.00

30-40 MC DELUXE FM RECEIVER. Model R-237/VRC—2 Single-Channel, Double-Conversion Superhet, with features such as double limiter, squelch circuit, crystal-control of both 1st and 2nd Converter Oscillators, built-in 6 V DC Power Supply, etc. Dimensions 11½" x 10" x 15". Used—Excellent condition units, with tubes, 2nd conversion crystal or control unit or loudspeaker, with schematic diagrams.
Shpg. wt. 65 lbs. **EACH $24.95**

TRANSMITTER COMPANION TO ABOVE. Model T-193/VRC—2. Power Output 25 watts. Crystal-controlled single-channel unit with built-in 6 V DC Power Supply. Can be used for NB FM amateur transmissions, or may be applicable to Fire, Police, or other applications. Used Excellent condition units. With schematic. Shipping weight 65 lbs. .... **EACH $14.95**

30 MC MOTOROLA COAXIAL ANTENNA. Heavy duty, high-power construction. Easily modified by reducing length of upper whip section for higher frequencies, or increasing length by a few inches for CB application. Present length of top radiator 102". Equipped with female receptacle for PL-259 coax connector and 50 ohm line. Important mounting hardware included. UNUSED Units. Shpg. wt. 130 lbs. **PRICE EACH $14.95**

HAM OR CB VERTICAL BEAM BARGAIN!



TELEMARINE discovered this outstanding 3-Element Adcock Type Beam Antenna in Army Surplus. It includes a vertical dipole and phase-load tuning box, which permits tuning and phasing in the radiator and director elements, and phasing out the reflector element so that an unusually high front-to-back ratio results along with exceptionally high forward gain. Plug-in inductors permits use of this antenna over a frequency range of 20 to 40.0 MC. Operates with 52 or 72 ohm transmission line. Sturdy, weather-resistant construction! Operates satisfactorily with CDR-AR-22 Beam Rotator, or equivalent. New-Unused, with Instruction Book which covers complete equipment for which antenna was intended, but provides full installation and tuning-up data. Net wt. of beam 39.5 lbs. Shpg. wt. 102 lbs. Supplied with 2 plug-in inductors to cover 25-30 MC, installed in phase-load box. **COILS PER PAIR** (2 required) for 20-22.5 to 25.0 MC; or 30-40 MC., specify freq. **$4.95**

FM MOBILE BARGAINS, FOR SPECIALISTS

GE MOBILE FM, 152-172 MC, Model ES-12A3, 15 Watts Output. Combination Transmitter Receiver, with built-in rugged 12-0 Volt DC Power Supply. Double conversion Superhet Receiver circuit, ideal for FM monitoring of hi-band FM transmissions. Used-Excellent condition, with all tubes, but less accessories. Shpg. wt. 50 lbs. **PRICE ONLY $32.50**

PHILCO 30-40 MC FM MOBILE TRANSMITTER, Model PRT-336T. Single-channel, crystal-controlled, with built-in 6 0 Volt Dynamotor Power Supply output of which is 600 volts at 175 ma. Excellent for conversion for Ham, CB, Emergency application and others. Used-Good condition, with tubes, but less accessories.
BARGAIN PRICE, ONLY $10.95

PHILCO 30-40 MC FM RECEIVER, Model PRT-336. Single-channel crystal-controlled. Easily changed to 110V. AC operation, and will make an excellent, inexpensive monitor of Low-Band FM transmissions. Used-Good condition units, with tubes but less accessories. Shpg. wt. 35 lbs. **PRICE ONLY ... $11.95**

All Above Material Subject to Prior Sale. 25%
Minimum Deposit with all C.O.D.'s Min. Order—$5.00
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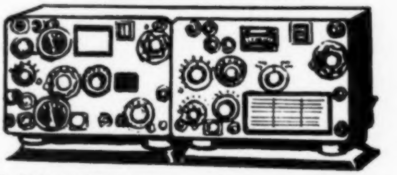
TELEMARINE CLOSEOUT SPECIALS!

SENSATIONAL BARGAINS!! TCS TRANSMITTERS, RECEIVERS, AND ACCESSORIES



TCS TRANSMITTER. Famous work-horse of the Navy, rugged efficient reliable. Delivers 20 watts phone, 40 watts CW in 1500KC to 12.0 MC range. Incorporates VFO or 4-crystal controlled channels. Excellent for mobile or fixed station use Complete with tubes. Used-Very Clean condition. Shpg. wt. 60 lbs. All Accessories extra.
EACH, not tested at this low price $34.95

TCS RECEIVER, companion to above 1.5 to 12.0 MC in 8-bands. Continuous tuning of 4 fixed crystal controlled frequencies selection. Employs a stage of RF amplification and 2 stages of IF to provide good sensitivity and selectivity. Requires separate Power Supply. Excellent for Hams, CD, MARS, etc. Shpg. wt. 50 lbs. USED—EXCELLENT Condition.
PRICE EACH, not tested at this low price, with tubes .. $42.50

TCS 12 VOLT DC POWER SUPPLY, to operate above units from 12 V. DC. Contains 2 Dynamotors, onefor transmitter and one for receiver supply, complete filtering, starting relay, etc. NEW UNITS. Shpg. wt. 40 lbs. **PRICE EACH** $15.75

TCS REMOTE CONTROL UNIT with built-in loudspeaker, volume control, microphone and phone jacks. Shpg. wt. 10 lbs. **NEW UNITS, EACH** $9.95

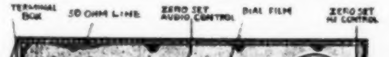
As Above, but "Used—Very Good" $6.95

Plug Connector for Remote Control $1.50

TCS CONNECTOR CABLE. Transmitter or Receiver to Power Supply. Shielded, (Specify which). 3 foot length **$5.95;** 11 foot length wt. 5 lbs. **$9.95.**

TCS ANTENNA LOADING COIL, permits use of short, whip type antennas on lower frequencies. Shpg. wt. 8 lbs. "Used—Good."
EACH $6.95

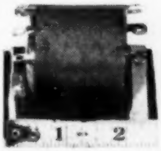
HI-PRECISION FM SIGNAL Generator—Mobile Band



Model I-208, is a precision instrument worthy of the finest lab, mobile service and installation shop, or for production testing of mobile FM equipment. Freq. Range in 2 bands. 1-9 to 4.5 mc (for IF alignment and tests) and 19 to 45 mc. Freq. of output of signal is maintained with .03% of dial calibration. Other outstanding features are: *Variable Frequency Deviation, 0-5 KC on 1.9 to 4.5 mc band, 0-50 KC each side of resting frequency on 19 to 45 mc band. *Calibrated Microvolter-Attenuator, adjustable up to 100,000 microvolts, developed at the termination of a 30-ohm line. Up to .84 volt available at high output terminals. *RF Vacuum Tube Voltmeter incorporated. 5 modulation frequencies provided by internal audio oscillator, 150, 400, 1,000, 2,500, and 5,000 cps. External modulation also provided for. *Operates from either 110 volts, 60 cycles AC, or 12 volts DC. *Crystal Calibrator, whose output is 1 mc and harmonics for checking and maintaining accuracy of signal generator. Complete with tubes, calibrator crystal. Instruction Sheets and Schematic Diagram. Shpg. wt. is 145 lbs. (in wooden case).

USED, EXCELLENT ....**EACH** **$39.95**

POWER TRANSFORMER FOR 12V. DC TRANSISTORIZED POWER SUPPLY 450 V. DC at 200 MA. From 12.0 Volts



Build your own Transistorized Mobile Power Supply for less than $15.00, and cut down battery drain 60% or more. Power Transformer employs powdered iron core (approx. 1,000 cms), with feedback winding, and at 300 ma load still delivers 410 volts. Dim: 2½" L. x 2½" H. x 2⅛" D. We furnish diagram & construction details. New Units. Shpg. wt. 1½ lbs. **EACH.** **$6.95**

LIMITED QUANTITY BARGAINS

BC-611 CHASSIS for famous Military "Handy-Talky". Covers 3.0 to 6.0 MC, crystal-controlled receiver-transmitter. Less tubes, plug-in coils, or tubes, or crystals. New Units. Shpg. wt. 6 lbs. **EACH** $7.95

BC-652 RECEIVER, excellent for Marine use. Two tunable bands covering 2-3.5 mc, and 3.5 to 6.0 mc, with contained dynamotor for 12.0 V. DC operation. 20 KC and 100 KC Calibrator insures precise dial calibration and frequency checking. "Like-New" units. Compact, but rugged. Shpg. wt. 55 lbs. **EACH** ... $29.95

BC-1335 FM TRANSCEIVER, 18 Tube Transmitter-Receiver operating 28.9 to 40 mc. Incorporates 6/12V. DC Power Supply, and crystal-control of both sections. Dim: 11⅛" L. x 10⅛" D. x 6¼" H. Compact and ideal for mobile. Very good condition. Shpg. wt. 45 lbs. **EACH, Complete with tubes** $24.95
EACH, Less Tubes $14.95

BC-923 RECEIVER. Similar to Famous BC-683, but provides 4-channels of permeability tuned pre-set frequencies, 27 to 40 MC. Includes Crystal Calibrator for frequency checking, and self-contained 12V. DC Dynamotor, plus loudspeaker. Excellent Condition. Shpg. wt. 60 lbs. **EACH** $32.50

GO-9 TRANSMITTER, 125 Watts Output Lo-&-Hi Freq. (200-500 KC, 1.5-18.0 MC), consists of 3 sections, low-freq. unit, hi-freq. unit, and 800 cycle AC power supply which are assembled into one piece. All aluminum construction, with 7 meters (inc. RF), x'mitting Var. Capacitors, silver-plated ceramic form coils, Dials, Vernier gears, etc. All New Units, ideal for modification or for parts for new transmitter. Shpg. wt. 250 lbs. **EACH** $62.50

951 PHOTOMULTIPLIER TUBE. Complete with wired circuit and encased in Mu Metal Shield. Ideal for Flying Spot Scanning TV. Shpg. wt. 5 lbs. **EACH** $6.95

GENERAL RADIO VARIAC, Model 200B, 115V. AC, 60 cycles to Zero V., up to 250 watts. 3" dia. x 2⅞" deep, with 6" long shaft (⅜" dia.). Used-Very Good units. Shpg. wt. 6 lbs.
EACH $5.95

BC-604 FM TRANSMITTERS. 10-Channel, Push-Button Selection, 20.0 to 28.0 MC. Complete with tubes. Excellent for mobile conversion. Less Dynamotor. Used-Very Good. Shpg. wt. 75 lbs.
EACH, ONLY $6.95

VOLTAGE REGULATOR TRANSTAT (Same as Variac), 1.3 KVA Rating. Mfd. American Transformer Co. Range 0-130 volts up to max. 10 amps. 6" Dia. (with commutator bar) x 7" H. plus 3" L. shaft, ½" dia. Shpg. wt. 20 lbs. **EACH** $12.95

BC-344D LOW FREQUENCY RECEIVER, 150 to 1500 KC in 4 bands. Superhet. Same construction and appearance as BC-342. For 110V. AC operation. "As-New" condition. Tested. **PRICE** $69.50

850V. POWER TRANSFORMER. Tapped Primary 0/105/110/115/120/125C 50-60 cycles AC, Secondary 850-0-850 at 160 ma. 6" H. x 6" W. x 4½" D. Shpg. wt. 12 lbs. **EACH** $4.95

550V. POWER TRANSFORMER. Same as above but 550-0-550V. at 200 ma. secondary. Shpg. wt. 12 lbs. **EACH** $4.95

FIL. & PLATE POWER TRANSFORMER. For 120 V. 50/60 cycles AC. Sec. #1, 650-0-650 at 150 ma.; #2, 6.3V, at 3.0A.; #3, 5.0V, at 3.0A.; #4, 6.3V, at 4 amps. Dim: 6" H. x 5" W. x 4⅛" D. Shpg. wt. 15 lbs. **EACH** $5.95

TWIN HI-FI 6" SPEAKER PANEL, by RCA for monitoring purpose. 19 inch x 8½' high Rack Panel with 2-6" Magnavox Speakers mounted, each controlled by separate Pads, each with separate Output transformer to permit individual 8 ohm or 500 ohm connections. Also 2 separate On-OFF "Squelch" Switches on Panel, allows use for Base Monitoring of Industrial and Business Stations. Shpg wt. 30 lbs. **EACH** $12.95

PLEASE!! DO NOT REQUEST CATALOGUES! MATERIAL LISTED IS "HERE TODAY, GONE TOMORROW," AND CATALOGUES WOULD BE USELESS.

All Above Material Subject to Prior Sale. 25% Minimum Deposit with all C.O.D.'s Min. Order—$5.00
All Prices F.O.B. Our Address
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SPERA ELECTRONICS

TWO METER CONVERTER OR RECEIVER

These transistorized components build a two meter receiver or can be used with your present receiver for excellent two meter reception.

MODEL SMC-2 two meter converter tunes 144-146 mc using three VHF transistors. Output is 4.3 mc. Fully tested. **$14.95**

MODEL IFA43 input 4.3 mc IF stage. Output goes to audio amplifier listed below. Fully tested. **$6.50**

MODEL MAT-4 audio amplifier. Output is to speaker. **$3.95**

Plastic formed case for above units—undrilled. **$3.25**

We also have vernier dials and speakers. Please inquire for these items. Other models available for 6 meters and police and fire frequencies.

INCLUDE POSTAGE ON ALL ITEMS

TELETYPE FREQUENCY SHIFT CONVERTER. Model CV57, less tubes, surplus. **$75.00**

VFO OSCILLATOR marked part of AN/FRT-23.RF range 600 to 800 kc. With 6SJ7 tube. 0.001 watt RF output. **$8.00**

30-42 MC DOUBLE CONVERSION FM superhet receiver. Has 10 band pass filters and 10 plate relays. Operates from 24 volts DC. Brand new condition. Surplus. 14 tubes included. **$25.00**

RADAR SCOPE INDICATOR Model 1P-183 BPS-4. Includes 13 tubes and 5" CRT. Weighs 140 lbs. This unit is fine for a real experimenter. **$29.00**

ARC-5 IF STRIPS. 6.9 mc surplus. **$3.20**

THORDARSON PLATE TRANSFORMERS. Input 220 volts. Output is 3000 volts CT, 500 ma conservatively rated. Weight 69 lbs. Brand new condition. **$17.95**

CRYSTALS TYPE FT-243. Any freqency **50¢:** 7725, 7900, 8000, 8025, 8050, 8150, 8175, 8225, 8250, 8275, 8300, 8325, 8350, 8400, 8450, 8525, 8600

CR-27/U CRYSTALS. Any frequency **95¢:** 7675.000, 7725.00, 7775.00, 7966.667, 8175.00, 8180.000, 8202.778, 8270.000, 8613.889, 8760.000, 8700.00, 8883.333, 9030.556, 9086.111, 9119.444, 9294.444, 9180.000, 9319.444, 9347.500, 9366.667

BLILEY type MC-72 186.30 kc	**90¢**
TV COLOR crystal 3579.545 kc	**98¢**

10 METER CRYSTAL 28.55556 mc. Can be used in CB rigs for ten meters. **$1.00**

2 METER FM TRANSMITTER uses 6252 in final. Made by Sperry model SP-1. Less tubes, with diagram. **$10.00**

TUBES: 902 2" CRT **$3.75, 6CW4 $1.50**

Note: We have a large selection of hard to find tubes, diodes and transistors. Please give specific types you are interested in. Send your name for our forthcoming catalog.

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If you are not interested in getting some of the best buys ever offered. Below are listed some offerings from our stock. This is by no means all that is available. Write us your requirements. We just might have it in stock or know where to get it.

ARB Receiver

Freq: 190 to 9050 kc (4 bands) Set-up for 24 volts, but easy to modify to 110 Volts or 12 volts D.C. Mfg. by R.C.A. $17.95

Dollar for Dollar you can't beat-

ARC-1 Transceiver

Freq: 100 to 156 Mc. Range 10 crystal controlled channels 8 watts output. Less crystals With tubes - - - - - - $29.95

Surplus from Communication

ART-13 Transmitter

200 to 1500 kc & 2 to 18.1 mc 100 Watt AM, CW & MCW. Mfg. by Collins. Can be automatically preset to any one of 11 Channels. $39.95

Sales

TDQ Transmitter

115-156 Mc. 50 Watt output AM Crystal Controlled 4 Channels VHF. Complete $129.00

GO BIG!!!! Additional infor-

BC-610 Transmitter

Freq. 2-18 Mc, 3 channels, 400 WATT CW, 300 WATT - - - - $395.00

mation available on all items

RDO Receiver

Freq: 38 to 400 mc. Covered by 5 plug in units. This unit is a Navy type APR-4. Metered for both RF & Audio Circuits. Complete with all 5 Plug-in tuning units - - - $425.00

On Request

Bendix Remote Reading Compass

Magnesyn Type. Consist of a Compass Transmitter, Remote Indicator & 12VDC Inverter. New Condition . . . $19.95

73 Special!!!!

TS-175/U Frequency Meter

85 to 1,000 mc. Crystal controlled, heterodyne type. Used for testing CW or MCW Transmitters & Signal Generators. LOOK! $99.00

Communications Sales

12 Volt Dynamotors

DM-42 Type. Input 12.5VDC at 39 Amps. Output 515 VDC at 215MA & 1030 VDC 260MA. New $9.95

Get on our Mailing list.

Teletype

We have Model 14 & 15 equipment & Parts. Write us your requirements.

GET ON OUR MAILING LIST

RAO Receiver

Freq: 540 to 30,000 kc covered in 5 bands. Superheterodyne, reception C.W., AM. Phone & MCW. Checked out
$89.00

WE ALSO HAVE RADAR

Wavemeter

Freq: S Band. Designed to measure frequency of Magnetrons without the use of an oscilloscope. Can also measure d-c crystal converter current. $9.95

EQUIPMENT FOR SALE

Headset

600 Ohm used for professional monitoring. Great frequency response and lack of distortion. With large chamoise pads Spec 73' buy $9.95

IDEAL FOR R&D LABS

Headset HS-33

600 Ohm low impedance, flat response 200 to 4000 cps. $5.95

SCHOOLS OR ? WRITE US

CARBON MIKE

Push-to-talk, with retractable coiled cord. Freq. response 200 to 4,000 cps. $3.95

YOUR REQUIREMENTS!

X-Band Signal Generator

Freq: 8500 to 9600 MC. CW & FM Pulse power meter. $19.95

BC-342 Receiver

Freq: 1.5 to 18mc. (6 bands) Selectivity: 14kc at 20db down to 2 mc. 250 to 4000 Ohms output impedance. Output power 8 watts. $79.95

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Wanted

Communication equipment, Test equipment, or what have you in the way of Electronics to sell or trade.

SMILE

Camera 16 mm

Magazine load type. Complete with F3.5 lens. Operated by 24 Volt motor. Excellent condition. $12.95

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Aeronautical

MLI-103-A Hoffman Tacan Test Set.
MD-83A (Collins 479S3) Omni Tester.
SG-1A, PP-348 (Boonton 211A) for VOR/ILS.
SG-13 (Collins 479T2) for VOR/ILS on ramp.
RT-128/ARC-21 Receiver-Transmitter.
RT-178/ARC-27 Receiver-Transmitter.
PP-2100/ARC AC power supply for ARC-27.

Amplifiers

AM-257/U, fixed gain of 5X DC current.
Brush BL-530 2-channel, DC to low AC.
Brush BL-905 1-channel, 2 cps to low AC.
Brush BL-913 1-channel DC to low AC.
Brush BL-932 1-channel DC to low AC.
Brush BL-968 2-channel DC to low AC.
Hewl-Pack. #460AR 3 kc to 200 mc.
Hewl-Pack. #490B 2-4 gc TWT, 10 mw Po.
I.F. Strip 60 mc pass 5½ mc gain 90 db.
Kintel 111BF calib. gains DC to 40 kc.
Microsen #143LA00 for DC mv.
(See also amplifiers in AC VTVM's here.)

Antenna Devices

Aer-O-Com DA-200 Artificial Ant. for bench.
DU-1 Loop D.F. has no 180-deg. ambiguity.

Audio Test Sets

Eico 377 sine and sq.-wave generator.
General Radio 736A wave analyzer.
General Radio 783A audio wattmeter.
General Radio 1301A low-distortion oscil.
Heathkit HD-1 harmon. distort. analyzer.
Hewl-Pack. 100D secondary freq. standards.
Hewl-Pack. 200CD oscillator.
Hewl-Pack. 202A function generator.
Hewl-Pack. 205A osc., calib. outputs.
Hewl-Pack. 205AG osc. and Gain Set.
Hewl-Pack. 300A harmonic wave analyzer.
TS-382D U microvolter-calibrated oscil.

Bridges, Precision Material

Boonton 160A Q-Meter, 50 kc to 75 mc.
MIL TS-617B/U similar to Boonton 260A.
Boonton 190A Q-Meter, 20-260 mc.
Boonton 590A-(*) Inductors for 190A.
Boonton 250A RX Meter.
Cornell-Dubil. CDB-3 Decade Capacity
Eppley Standard Cell Type 2KM 5-digit.
Eppley Standard Cell Cat. 100, 6-digit.
E.S.I. 250-B1 Impedance Bridge, battery.
Freed 1010 L-C-R Comparison Bridge.
Gen. Radio 500G 600 ohm .05% resistor.
Gen. Radio 578B 3-Shield Transformers.
Gen. Radio 650A Impedance Bridge.
Gen. Radio 722 is in MIL Telectro 0-3.
Gen. Radio 1432M Resistance Decade Box.
Res. box 0-11 meg. 8-dial, G.R. Decades.
Gertsch RatioTrans PT-2, -5, -7, -11 & #10.
Heathkit DC-1 Capacitor Decade Box.
Kay Lab (Cohu) 402B Dynamic Micro-Miker.
L&N 2165 Ayrton Shunt Box 40 K ohms.
L&N 2310-c and -d pointer galvanometers.
L&N 2420-b light-beam galvanometer.
L&N 2430-c light-beam galvanometer.
L&N 4285 Portable Kelvin Bridge.
L&N .01% 3-dial 20K ohm Voltage Divider.
L&N 4395 .001% 100K ohms volt divider.
L&N 4725 5-dial .01% Wheatstone Bridge.
L&N 5365 Cable Fault Bridge.
L&N 7651 Student's Potentiometer.
L&N 8687 Portable Potentiometer
Rochester Elec. #7 RMA-values Res. box.
Rubicon 3402 & 3417 light-beam galvos.
Shallcross 645 Kelvin Bridge w/leads.
Solar Exameter R & C Bridge.
Weston 440 pointer galvanometer
Weston 604 Type 2 Current Transformers.
ZM-3/U is Shallcross MIL R & C bridge.
ZM-4B/U: MIL Wheatstone Bridge .15%.
CLB-60007: MIL R & C Bridge.
500 K ohm 0.1% 1W non-ind. WW resistors.

Communications & Other Receivers

RAK-7 & RBL-5: 15-600 kc, TRF types.
DZ-1: Superhet 15-70 & 100-1500 kc.
R-23/ARC-5: "Q-5'er" Command, 190-550 kc.
ARC Type 12 R22: Command, 540-1600 kc.
BC-348-P: .2-.5 & 1.5-18 mc, w/AC Pwr.
RBS-2: 2-20 mc w/pwr sply & AF Amplifier.
R-45/ARR-7: .55-43 mc, pwr sply optional.
R-44/ARR-5: As above but AM/FM 27-140 mc.
SP-600-JX: 0.54 to 54 mc A1 A2 A3.
R-388/URR: .5-30.5 mc AM cw, voice, fsk.
R-390 & R-390A/URR: As above, .5-32 mc.
R-266/URR-13: 222.75 to 404 mc AM.
APR-4 w/Tuners .038-1, -2.2, -4 gc. AM.
APR-4Y as above but AM/FM, 60 cy pwr.

Commun. Xmtrs, Xmtr-Rcvrs, Pwr Splies

T-19/ARC-5 Command xmtr, 3-4 mc.
TCS-12, 1.5-12 mc, 12v dynam., 50 W A3.
ART-13 less pwr sply, 2-18 mc, 100 W Po.
TCM AC Pwr Sply is suitable for ART-13.
AN/FRC-6A Fixed Station 30-40 mc FM, 50 W.
TDZ Fixed Station 225-400 mc AM, 30 W Po.
AN/GRC-27 225-400 mc AM, 100 W Po.
EAO is AC Pwr Sply for TBX Rcvr Section.
RA-62-B is AC Pwr Sply for SCR-522.
2 KV DC Variac-controlled NBS-made Pwr.
GN-45B Hand-Cranked Pwr for Field use.

Counters & Freq. Meters

H.P. 522B Universal Counter to 120 kc.
Berkeley 5510 Universal E/UT past 1 mc.
Use plugins w/H.P. 524A w/Adapter K01.
H.P. 525A 10-100 mc freq. extend. plugin.
H.P. 526B Time Interval plugin.
H.P. 526C Period Multiplier plugin.
H.P. 526D Phase-Angle Reader plugin.
H.P. Patch Cord for all plugins above.
H.P. 540A Transfer Oscillator to 5 gc.
Gen. Radio 1110A Interp. Osc. to 3 gc.
LM Freq. Meter .125-20 mc CW/AM.
BC-221 Freq. meter .125-20 mc CW only.
FR-4 U freq. meter .1-20 mc late type
TS-323/UR freq. meter 20-480 mc CW/AM
Gertsch FM-3 freq. meter 1-1000 mc .001%.
Gertsch AM-1 VHF Interpolator .000001%.
Lavoie LA-70B freq. meter .0001% to 3 gc.
TS-69/AP Wavemeter 350-1000 mc.
P.R.D. 504 Freq. meter .1-10 gc .03%
H.P. X-532-B imitation. 8200-9825 mc.

Meters, VTVM's, Calibrators, DVM's

Greibach 0-50 microamps DC, ½%, in case.
Hoyt 515 0-15 A DC fan. mirror scale.
Jewell Pattern 11 0-15 A AC ¼ % in case.
Weston 45 1/10/50 A DC ½% in case.
Weston 155 5/10 A AC ½%.
Weston 269 4" fan. 1 ma DC ½%.
Weston 341 AC/DC 150v 0.17% & 0.25%
Weston 432 Wattmeter 375/750/1500 W ½%.
Weston 433 0-150 v AC ¾%.
Weston 433 0-500 ma AC ¾%.
Weston 904 0-10 A AC ½%.
Weston 924 0-150 VAC 1%.
Weston 931 0-50/100/200 ma DC ½%.
Westinghouse PIX-14 0-150/300 V DC 1%.
Westinghouse PX-5 0-150/300/750 VDC ½%.
TS-352A/U (ME-9E/U) MIL Multimeter.
Weston 785 Industrial Circuit Tester.
Winslow 561000 (ZM-21A U) crank megger.
AN/USM-34 (ME-81) MIL VTVM reads AC MA.
Ballantine 300 AC VTVM .01-100 v rms FS.
Dressen-Barnes Ripple Meter rms VTVM.
Heathkit AV-3 Audio VTVM, assembled.
Hewl-Pack. 400AB AC VTVM 3 mv FS & up.
Hewl-Pack. 400D & 400H AC VTVM's.
Hewl-Pack. 410B all-purpose VTVM.
H.P. 455A RF T Connector for 410B probe.
H.P. 456A Clamp-On AC current probe.
Ind. Cont. 200A converts mv DC to mv AC.
Measurements Corp. 62 AC-DC VTVM.
Millivac MV-17C DC mv VTVM.
Millivac MV-171 current shunt for above.
Millivac MV-18C RF mv VTVM.
RCA WV-97A Voltohmyst Sr. VTVM.
Boonton 345D Calibrator for RF Vo.
Fluke 8011A DC VTVM is .05% Calibrator.
Gen. Radio 1651A Bol. Bridge RF Vo Calib.
Meas. Corp. 202 Bol. Bridge RF Vo Calib.
Cubic AC-1 AC converter for any Dig. VM.
Elect. Inst. DVA-510 DC 5-digit Dig. VM.
NLS 125E AC Converter modif. for any DVM.
NLS 141 preamp for DC DVM, 10X .08%.
NLS 451 4-digit DC Digital Voltmeter.
NLS 4511 4-digit AC/DC digital voltmeter.

Microwave and Attenuators

Douglas 127 15 db atten., octave calibr.
FXR N200A det. mt. w/det., N in, BNC out.
Hewl-Pack. 415A SWR meter.
Kay Mod. U Microwave Meganode Pwr Sply.
Kay Meganode Noise Diode Pwr. Sply.
Microlab AF-6 6 db 50 ohm atten., N ends.
P.R.D. 205A 4-10 gc slotted line.
Sperry 3881 Barreters 200 ohms 8.75 ma.

Miscellaneous

Rayth. 18A DC Welder pwr unit 19 W-sec.
Raytheon "Weldpower" 5 KVA AC 3-pc Set.
1000 W lamps, Mogul base (dummy loads).
BB-401/U 26 v NICAD battery set in case.
Buffalo Inst. FDT-1 Yaw/Pitch Transducer.
Assorted Power Rheostats for dummy loads.

Noise & Field Strength Meters

URM-50 field strength only, .3-400 mc.
Ferris 32A .15-.35 & .55-20 mc, battery.
Stoddart URM-6B (NM-10A) 14-250 kc.
Stoddart PRM-1 (NM-20A) .15-25 mc.
Stoddart TS-587 (NM-5A) 100-400 mc.
Stoddart NM-50 375-1000 mc.

Oscilloscopes

AN/USM-25, -25B MIL syncroscopes.
DuMont 304H popular 5", DC-100 kc.
DuMont 322 dual-beam is 2 304's combined.
DuMont 333: Later 5" dual-beam to 200 kc.
Hewl-Pack. 150A 5", DC to 10 mc.
Hewl-Pack. 152A, B dual-trace plugins.
Hewl-Pack. 153A differ. ampl. plugin.
Hewl-Pack. 154A voltage & current plugin.
USM-140B: H.P. 170B 35 mc, w/2 plugins.
Hycon 617 is 3" 6 cy to 4½ mc.
Lavoie LA-265: Exact copy of **Tekt. 545A.**
RCA WO-79A is 3" 10 cy to 5 mc.
Tektronix 511AD is 5 cy to 10 mc.
Tektronix 512 is hi-grain DC to 2 mc.
Tektronix 513D is DC to 20 mc.
Tektronix 514AD is DC to 10 mc.
Tektr. 532: plugin type, DC to 5 mc.
Tektronix 533A is DC to 15 mc.
Tektronix 541, 541A: DC to 30 mc.
Tektronix 545 as above plus Delay.
Tekt. 53B, 53C and K plugins.

Panadapter

BC-1031-A: Has 60 cy pwr sply, 455 kc in.

Pwr Splies, Precision Calibrators

DuMont 264B scope deflection calibrator.
Exact El. 100RM: DC & sq-wave Vo's, ¾ %.
Fluke 301C: 1.01-1012 VDC .1%, 0-400 ma.

Power Supplies, Regulated DC

Sorensen Q28-0.5: 18-36 v 0-500 ma.
Dres-Barnes 28-5: Fixed 28 v 0-5 amps.
Nobatron E-28-30: Fixed 28 v 0-30 amps.
Lambda LT-1095: 0-32 v, 0-1 amp.
Surface-Air: 0-30 v, 0-15 amps.
Milro 2226-1: 5-36 v, 0-30 amps.
Dres-Barnes 22-102: Fixed 300 v, 0-70 ma.
Elect. Meas. 200B: 0-300 v, 0-125 ma.
Sorensen 300B: 0-300 v, 0-150 ma.
Dres-Barnes 3-150B: 0-300 v, 0-150 ma.
E.R.A. TR-300-1: 165-300 v, 0-1000 ma.
NJE S400C: 0-300 v, 0-300 ma.
Power Designs 351M: 150-350 v, 0-150 ma.
Oregon Elect. B3: 0-350 v, 0-200 ma.
Hewl-Pack. 710B: 100-360 v, 0-100 ma.
Hewl-Pack. 712BR: 0-500 v, 0-200 ma.
Univ. Elect. UP520B: Same as above.
Dres-Barnes 5-300F: Same as above.
Dres-B. 62-109: Dual 0-300 v, 0-105 ma.
Dres-B. D3-150B: Dual 0-300 v, 0-150 ma.
NJE S-2400: 2 of the S-400 in 1 cabinet.
NJE CS1300TRM-1.5: .9-1.3 KV, 0-1.5 amp.
Trans-El. RS399A: Fixed 10 KV 0-100uA.

Power Supply, Electronic 400 Cy

Behlman Inv.: 115 v 3 ph 500 VA Po.
Behlman Invertron: 115 v 3 ph 500 VA Po.

Pulse, Delay & Time Generators

Electropulse 2120A: 4 panels & pwr.
Electropulse 2210A: #210B plus pwr.
Hewl-Pack. 212A: 50-10,000 pps.
Kay Radapulse 470A: Carrier & pulses.
Meas. Corp. 79B: 60-100,000 pps.
Rutherford B2: 10-100,000 pps hi-pwr.
Tektronix 107: 400 kc to 1 mc.

Radar, Beacon, IFF Material

TS-453: Cap. V-Divider to 100 KV peak.
RT-211/TPX: Rcvr-xmtr 990-1040 mc., IFF.
AN/UPM-4A, -4B Test Sets for above.
AN/UPM-6B Test Set for above.
TS-501/UP Echo Box: 6250-6900 mc.
TS-311A/AP Echo Box: 8730-8910 mc.
TS-488/U Echo Box: 8990-9610 mc.
TS-573B: Range Calibrator.
MD-128B/FPS-3: 28 KV for 3 & 6 usec.
AN/APN-81: Complete Doppler Radar.

Recorders, Graphic

Varian G-10: 0-10 mv DC potentiom.
Var. G-10 100 mv electronics/servo only.
Mesco JY110-1: 0-10 mv to 100 v DC., pot.
Bristol PH-663 Dynamaster: ⅕-0-⅕ mv DC.
Brush BL-202: 2 channel 1.1 mm/v.
BL-222/BL-944: Same for ink & elec. wrtg.
RD-2321-00: Late model of BL-202.
Brush BL-206: 6 channels like BL-202.
Edin 806A: Buy for the 4 penmotors.
G.E. portables 0-⅛ ma, 0-52 mv DC.
Hewl-Pack. 560A: Digital printer.

Recorders, Tape

RO-14/APH (air) & **RP-119/GPH** (ground).
Solva CVH 250 VA low harmonics 118 Vo 1%.
Sola 30807 250 VA hi harmonics 115 Vo 1%.
Sola 30808 500 VA hi harmonic 115 Vo 1%
Sorensen 500S 500 VA low harm., 0.1% reg.
Sola CVS 1 KVA low harmonic 118 Vo 1%.
Sola 30809 1 KVA hi harmonic 115 Vo 1%.
Raytheon VR6116 1 KVA hi harm. 115 V 1%.
Sorensen 1000S 1 KVA low harm. 0.1% reg.
Staco 8537 is same exactly as above.
Superior Elect. IE-5101 is same as above.
Sola CV 220: 115 V 2 KVA hi-harm. 1%.
Sorensen 2000SHJM1 2 KVA low harm. 0.1%.
Sorensen 2000S 2 KVA low harm. 0.1% reg.
Sup. Elect. IE-5102 2½ KVA low harm. 0.1%.
Sorensen 3000S low harm. 0.1% regul. 3 KVA.
Sup. IE-20060 3 KVA low harm. 0.1% regul.
Sup. IE-5205P 5 KVA 230 V low harm. 0.1%.
Sup. EM4106 6 KVA mechanical no harm. 1%.
Gen. Radio 1570AL 6KVA electromechanical.
Sorensen 10,000S 10 KVA low harm. 0.1%

Rotary Machines

Stoddart 90069-2 12 V 16A to 115 V 60 cy.
Carter JR1080C 28 V 5A to 115 V 60 cy.
Alternator, no motor, 2.4 KVA 400 cy 1 ph
Bendix Autosyns & Selsyns, Various.

Schematics, Tech Manuals

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Signal Generators, AM, Low Frequency

Gen. Radio 605B 9½ kc to 50 mc.
Navy LP-(*) is same as above, in 2 parts.
AN/URM-25(*) 10 kc to 50 mc.
TS-413/U 75 kc to 40 mc.
Meas. Corp. 65-B 75 kc to 30 mc.
Gen. Radio 1001A 5 kc to 50 mc.
Borg-Warn. 20 (TS-606) .085-40 mc hi pwr.
Boonton 203A, 207A Univerters.

Signal Generators, AM, VHF

Meas. Corp. Mod. 80 2 to 400 mc.
TS-497(*)/URR Mil version of above
AN/URM-26(*) Mil 4 to 408 mc.
Hewl-Pack. 608-(*) 10-400/500 mc.
Gen. Radio 1021 P1 P3: 47 to 260 mc.
Gen. Radio 1021A P1 P2: 248-940 mc.
Borg-Warner 30 (TS-608) 42-400 mc hi pwr.

Signal Generators, AM, Pulse, UHF

Rohde-Schwarz SLRD 275-2750 mc hi pwr.
TS-418A (URM-49) 400 to 1000 mc.
TS-419 (URM-64) 900-2100 mc.
Hewlett-Packard 616A 1800-4000 mc.
TS-403A/U (URM-61) 1800-4000 mc.
URM-35 (needs 400 cy pwr) 4450-8000 mc.
Hewl-Pack 623B (klyst. for 7125-7750 mc).
Hewlett-Packard 624C 8500-10,000 mc.
TS-622 (URM-44) 7000 to 10,750 mc.
P.R.D. 903 7000 to 10,750 mc.
TS-739/UPM-10 8500-9600 mc.

Signal Generators, FM, AM/FM

Boonton 152A 1-5 and 20-28 mc.
TS-452B/U 5 to 100 mc mechanical sweep.
Boonton 240A 4½ to 120 mc.
SG-93/URM-75 5 to 220 mc.
Boonton 202D 175 to 250 mc.
Boonton 202F 175 to 250 mc.
USM-16 (Borg-Warn. 75) 10 to 440 mc.
Borg-Warner 75B 10 to 440 mc.
Kay 111A Megasweep 10 to 950 mc.
P.R.D. 907 40 to 900 mc.

Sonar Test Sets

OAX-1 and OCP-3: 17 to 26 kc.

Spectrum Analyzers

Polarad SD-1 Multipulse Selector.
Polarad ISA w STU-3A 4400-22,000 mc.
PRD 855A 3-3.7 & 8-10 gc. 3" scope.

Telemetry

Nems-Clark 1670E rcvr; **Bendix TDA-608** subcarrier discriminator; **TFB-601** band-pass filter; **TFA-601** filter amplifier; **TPR-601** pwr sply. All IRIG channels plus reference frequencies per MIL T 26985.

Telephony

Automatic message Recorder, inexpensive.
A.E. #80 (desk) & **#90** (wall) dial phones.

Teletype

Reconditioned, Repainted **#14 Reperf's. #15 & #19 Send and Receive.**

Transformers

120 v to **two 6.3 v CT** each **35 amps.**
7½ KVA, 3 isol. wdgs: 115/115/105-125 v.
Triad M66A: Isolated 115 to 230 v 250 VA.
Variacs, 15 amps, and smaller.
Freed 12691 Scope Transformer for **DAS.**
SP-600 replacement potted **power xfrms.**
115 v 60 cy 1 ph to **2400 v1 A** no CT.

Tube Testers

Precise Development Gm & Em portable.
AN/USM-3 Tube-Tester Section.
Weston Mod. 981 Type 3 in carry case.
Weston 686 Type 9B industrial analyzer.

Tuning-Fork Oscillators

400 cy: Am. Time Prod. #2001-2 fork only.
400 cy: Same on module chassis w/tubes.
400 cy: Above module in case w/pwr sply.
400 cy: Varo #622B also **Philamon.**
960 cy: #2001-2 module complete.
2 kc/10 kc: #2001-2N 2-part module.
1000 cy: #2003, w/countdowns to 62½ cy.

Ultrasonic Generator, Bendix

UG-3: 200 W into 100 ohms at 28-35 kc.

Wattmeters, RF

ME-11/U (URM-43, Bird 611): Termaline.
Bird 67: Termaline, read 1 to 500 W.
TS-125/AP: S-Band, to 4 W w/attenuators.
Sperry #123B: Wattmeter Bridge.
Hewl-Pack #430-(*): 0.1 to 10 mw FS's.
PRD 650A Univ. Pwr Bridge.
Cable Corp. Calorimetric MC-1B 20 27 gc.
Cab. Corp. Calorim, MCX-1A is coax type.
Chemalloy-Kahl Calorimeter guide & coax.

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410A—AC DC VTVM, DC—0 to 100V, AC—0 to 300V, Ohms .2 to 500 Megohms, Frequency to 700 MCS 125.00

410B—SAME SPECS—LATER VERSION ...155.00

415A—SWR INDICATOR—Special 55.00

430B—MICROWAVE POWER METER, .01 to 10 Milliwatts 125.00

460B—WIDE BAND AMPLIFIER, 20 KC—120 MCS 90.00

417A—VHF DETECTOR, 10-500 MCS 250.00

485B—DETECTOR MOUNT, 8.2 to 12 KMCS 40.00

487B—THERMISTOR MOUNT, 8.2 to 12.4 KMC 40.00

491A—TRAVELING WAVE AMPLIFIER, 1 Watt Output at 2 to 4 KMCS, TW Tube is Huggins HA-2HPA, Very high list price (1400), clean unit, all okay 395.00

500B—FREQUENCY METER, 3 CPS to 100 KC, Expanded Scale, Input .2V Minimum—Maximum 250V, Peak VF 150.00

512A—FREQUENCY CONVERTER, Used to extend frequency range of electronic counter (524R) 100-200 MCS 200.00

524A—FREQUENCY COUNTER to 10 MCS, with 512A convertor to extend range to 200 MCS, includes mounting rack. Complete package. All Excellent condition. 850.00

525B—Frequency CONVERTER FOR COUNTER extends range from 100-220 MCS, Plug-in-type 150.00

526A—VIDEO AMPLIFIER, Increases counter 10 CPS to 10 MCS. Sensitivity to 10 Millivolts 125.00

540A—TRANSFER OSCILLATOR, Extends range of 524 counter 10 MC to 5 KMCS. Measures FM deviation. Self contained 2" scope exc. condition 400.00

LAB EQUIPMENT

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616A—UHF SIGNAL GENERATOR, 1.8 to 4 KMCS. Direct calibration in microvolts. Output continuous, pulsed, on frequency modulated 850.00

710A—REGULATED POWER SUPPLY 40.00

712B—REGULATED POWER SUPPLY, 500V—200 Mils. 200.00

805A—SLOTTED LINE ("N" Fittings) 500 Mc.-4 KMC. 200.00

GENERAL RADIO

DECADE RESISTANCE BOXES

- 102F Tenths Units Tens 35.00
- 102G Tenths Units Tens 35.00
- 102J 1 to 11,100 Ohms 4 ranges 50.00
- 102L 10th, hun., thou., 10K 35.00
- 102S Units 10's Thousands 35.00

ATTENUATION BOXES

- 249H 600 Ohms 60.00
- 249T 600 Ohms 60.00

546B—AUDIO FREQUENCY MICROVOLTER, .1 Mu/Volt—1 Volt. Used in conjunction with an escillator for response measurements of amplifiers, xfermers, etc. 80.00

561D—VACUUM TUBE TESTER and BRIDGE, Transconductance, amplification factor, and dynamic voltage checks, etc. made rapidly with adaptors) LN 150.00

583A—POWER OUTPUT METER, 0.1 to 5000 Milliwatts in 4 Ranges. VF 125.00

602J—DECADE RESISTANCE BOX, 10 Ohm Steps E 35.00

602L—DECADE RESISTANCE BOX, 10-111KOhm 50.00

602M—DECADE RESISTANCE BOX, 10 Ohm Steps G 35.00

605B—STANDARD SIGNAL GENERATOR, 9.5Kc. to 30 Mc. VG. 295.00

LAB EQUIPMENT

GENERAL RADIO

631B—STROBOTAC, 600 to 15,000 RPM ..110.00

650A—IMPEDANCE METER BRIDGE, Inductance Reading 1 to 100 Microhenry; Capacitance 1 Mmfd. to 100 Mfd.; Resistance 1 Milliohm to 1 Megohm 150.00

NOTE: 650A with 650P1 (Oscillator and AC Supply) 225.00

675L—PIEZO ELECTRIC OSCILLATOR 395.00

700A—WIDE RANGE BFO 50 CPS to 5 Mcs. E 300.00

713B—BFO—20-20KC 195.00

715A—DC AMPLIFIER, Input .1 to 1 Volt N 100.00

716—CAPACITANCE BRIDGE, 100 UUF. to 1.1 Mfd. 225.00

720A—HETERODYNE FREQUENCY METER, 10 to 3000 Mcs. E 250.00

722D—PRECISION CAPACITOR, Dual Range 25 to 115 mmfd., 100 to 1150 MMfd. VF..125.00

722M—PRECISION CAPACITOR, 0 to 1000 Mmfd. E 95.00

722N—PRECISION CAPACITOR, 100 to 1100 Mmfd. E 95.00

723C—VACUUM TUBE FORK, 1000 CPS VF 95.00

726A—AC VTVM, 1.5V, 5, 15, 50, 100V G 50.00

728—DC VTVM 75.00

729—MEGOHMETER 75.00

736A—WAVE ANALYZER, 20 to 16 Kc. Single Band E 395.00

740B—CAPACITY BRIDGE, 100 Mmf. to 1.1 Mf. at 1 Kc. 100 Mmf. to 1150 Mmf. at 100 CPS, 10 Kc., 100 Kc. E 175.00

759—SOUND LEVEL METER VF 150.00

760—SOUND ANALYZER LN 250.00

761A—VIBRATION METER LN 250.00

762—VIBRATION ANALYZER LN 250.00

LAB EQUIPMENT

GENERAL RADIO

620A—HETERODYNE FREQUENCY METER, 300 Kc. to 300 Mcs. 275.00

805—STANDARD SIGNAL GENERATOR, 10 KC to 50 MCS 7 Ranges, Variable Output 0.1 U/V to 2V. Variable Modulation G 350.00

821A—TWIN T IMPEDANCE MEASURING CIRCUIT 325.00

916A—R. F. BRIDGE, 50 KC to 5 MCS VG 350.00

1001A—STANDARD SIGNAL GENERATION, 5 KC—50 MCS—8 Ranges, 11 to 200 Microvolts 450.00

1107A—INTERPOLATION OSCILLATOR, 0-5 KC, Linear Scale 450.00

1140A—WAVEMETER 45.00

1217A—UNIT PULSER W/1203B, Power Supply 125.00

1231B—AMPLIFIER AND NULL DETECTOR 125.00

1231P—4-ADJUSTABLE ATTENUATOR ...90.00

1301A—LOW DISTORTION OSCILLATOR, 20-15 KC (27 Push Button Frequencies in this Range) 250.00

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Hickok 209A VTVOM 9" Meter	60.00
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Dumont 185A Electronic Switch & Square Wave Gen.	40.00
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Heath 5" 'Scope	30.00
Dumont 5" 'Scope 208B	50.00
RCA 5" Scope WO 88A	50.00
RCA 5" 'Scope WO 60C	60.00
Eico 5" 'Scope 460 Wide Band	70.00
G.E. 5" 'Scope ST 2E	125.00
Sylvania 7" 'Scope 132	45.00
RCA 3" 'Scope WO 79B. Triggered Sweep, Etc. Lab Scope	150.00
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K—PLUG-IN-UNIT, Fast rise DC unit (used with 530, 540, 550 and 580 Series Scopes)	75.00
53A—PLUG-IN-UNIT FOR SCOPE, (531, 535, 545, etc.) Wide band DC Pre-Amp	50.00
53B—PLUG-IN-UNIT FOR SCOPE, Wide band, high gain, calibrated	65.00
80—VERTICAL PLUG-IN-UNIT with P80 Probe, use with 580 series oscilloscopes, both units	85.00
B93R—TERMINATION RESISTOR, 1.5 Ohms—93 Watts	6.00
105—SQUARE WAVE GENERATOR, 25 CPS to 1 MC, 15V output, rise time less than 20 NSEC into 93 Ohms, as short as 13 NSEC under suitable condition	195.00
121—WIDE BAND PRE-AMP, .01 to 100 Voltage Gain. 5 CPS to 12 MC Response Output IV	85.00
122—LOW LEVEL PRE-AMP, Voltage Gain-Low—100, High—1000. Use to increase sensitivity of any DC Couple Scope	75.00
161—PULSE GENERATOR, Supplies calibrated, rectangular output pulses from 0 to 50V and 10 Micro sec. to 100 Micro sec., when an external trigger of required voltage is received	65.00
180S1—TIME MARK GENERATOR (Rack Mount), 14 Time Mark Intervals plus 3 Sine Wave Frequencies plus 6 Trigger Rate Freq.	350.00
181—TIME MARK GENERATOR, 5 Time Mark Intervals 1, 10, 100, 1000, 10,000 Microseconds plus 10 MC. Sine Wave	150.00
190A—CONSTANT AMPLITUDE SIGNAL GENERATOR, Output Freq. 350 KC to 50 MCS (6 bands) Output Voltage 4 Millivolt to 10 Volts	175.00

LAB EQUIPMENT

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310A—OSCILLOSCOPE (Portable) 3", DC—4 MCS, rise time 90 N sec. automatic triggering	395.00
511 (511AD) OSCILLOSCOPE—5" 10 CPS to 10 MCS	175.00
512D—OSCILLOSCOPE—5" .3 CPS to 500 KC, 5 MV per CM	275.00
513D—OSCILLOSCOPE—5" Distributed type vertical amplier DC to 20 MCS. 30 MV/CM, 1 KC sg. wave calibrator	375.00
514AD, 514D—OSCILLOSCOPE—5", DC to 10 MCS at .3V/CM and 5 CPS to 10 MC at .03V. CM. Square wave calibrator	325.00
517A—OSCILLOSCOPE 5" H16h speed 'scope—7 NANO Second Rise Time. Sweep 10N sec/CM to 20 Micro Sec/CM. Vertical defl. 0.05/CM Cart, Power Supply, Cable, Probe—Complete Set	850.00
524D—OSCILLOSCOPE 5", DC-10MCS. Delayed Sweep, etc.	450.00
531—OSCILLOSCOPE 5", DC-10MCS—Less Head	
535—OSCILLOSCOPE 5" DC-30MC	

KAY

MEGA PIX—provides 12 channels for color circuit TV or production set-up	250.00
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MODEL MEGA-SWEEP JR.	50.00
MICROWAVE MEGANODE, DC—Power Supply	250.00

LAB EQUIPMENT

VECTRON

#SA-10 Spectrum Analyzer with X Band RF Head #10X	250.00
#SA-25 Spectrum Analyzer with X Band RF Head #20V	350.00
#SA-30 Microwave Spectrum Analyzer with X Band RF Head #30X	400.00
#251X1 X Band RF Head	100.00

HEWLETT-PACKARD

150A—5" OSCILLOSCOPE with #151, Hi-Gain Amp, Horiz. DC-500Kc., Vert. DC-10 Mcs.	595.00
166A—AUXILIARY PLUG-IN UNIT FOR SCOPE	30.00
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205AG—AUDIO POWER SIG. GEN., 20-200 KC, Input, Output Metered. Multi-Load Match	250.00
210A—SQUARE WAVE GENERATOR	90.00
212A—PULSE GENERATOR, Pulse Width .07 to 10 Micro Sec., Pulse Rise .02 MU/Sec.	300.00
281A—WAVEGUIDE TO COAX ADAPTER, Type N to AN Flange	15.00
325B—DISTORTION ANALYZER, 30 CPS, 4 KC	150.00
337B—FM MONITOR and DEVIATION METER	350.00
400A—AC VTVM, .03-300V—9 Ranges	45.00
400B—AC VTVM, .11-300V	65.00
400C—AC VTVM, .001-300V—to 4 MCS	100.00
400D—AC VTVM, .001-300V—4 MCS. 12 Ranges	150.00
404A—AC VTVM, .001-300V—Portable, Battery Operated, W/Batteries	95.00

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Model 14 reperferator roll-a-way type, complete with base & motor	39.50
Model 14 TD with governor motor crypto type	17.50
255 Relay for Teletype	2.49

SPECIAL

RT-1-FSK teletype converter, designed and built by Don Stoner (need we say more) new	99.50
Model 15 paper, 10 rolls to carton	per carton 9.95
Model 14 reperferator paper tape 11/16", 40 rolls to carton	per carton 8.95
88 MH toroid coils, potted	5 for 1.49
unpotted	5 for 1.75
Toroid for transistor mobile power supply (QST Dec. 1964) laminated core for 275 watts (stack 2 for 375 watts)	1.95
Variac core for 650 watts M-10	5.95

TUBES

2" scope tube 902A new, boxed	$2.95
3C22 lighthouse tube	2.95
1P28 photo multiplier	3.95
6414 same as 12AU7	10 for 1.95
717A same as 6SK7, 6SJ7, 6AK5 etc.	20 for 4.95
3B28 bulk packed tube	1.95
807 bulk packed tube	1.25
6L6 bulk packed tube	1.25
5R4 ruggedized bulk packed	1.49
5998 same as 6AS7	5 for 1.00
3EP1 3" scope tube	1.25
3DP1 3" scope tube	.75

SEMICONDUCTORS

2N176	ea. 79¢
5 amp at 200 volts	79¢
500 ma at 300 PIV	49¢
12 amp at 100 volts	79¢
3 amp at 100 volts	49¢
2N328	49¢
Integrated circuit	49¢
Differential amplifier NPN	49¢

(Above sold as is)

CRYSTALS

200 KC in metal holder	$1.49
200 KC in FT-241 holder	1.75
9.050MC in metal holder	1.25
13MC in metal holder	1.49

CRYSTALS WITH FRACTIONS

26MC
27MC
39MC
40MC
42MC
43MC
44MC
45MC
46MC
48MC
49MC

Low frequency crystals ranging from 370KC to 540KC in 1.388 steps	49¢ ea. or 10 for 3.95
Crystal Kits for BC 611 or Walkie Talkie consisting of 24 crystals, 5 antenna coils and 5 tank coils all in a wood carrying case	per kit $3.95

TRANSMITTERS & RECEIVERS

COLLINS ARR-15 Receiver, 1.5 to 18.5 MC with Collins PTO & calibrator, in good condition	ea. $49.50
URR-13 Receiver, continuous tuning AM superhet, 225-400MC plus 1 crystal control channel, 2 stages RF, 5 stages IF, 110 VAC, 60 cycle, in good condition, unchecked	ea. $97.50
CBM Low Band Receiver, amplifier and power supply, new with all tubes, frequency 20.6 to 23.8 KC	$9.95
COLLINS MBF in good condition with spare part case	$65.00
SUPER PRO SPECIAL, receiver contains its own built in power supply, up to 20MC	$97.50
SUPER PRO RECEIVER, with external power supply up to 20 MC, Receiver used, good and power supply new	$79.50
ARC 5 VHF TRANSMITTER, 100-156 MC in new condition	ea. $14.95
ARC 5 6-9 Receiver	ea. $9.95
BC-1000, PORTABLE TRANSCEIVER, 40-48 MC, converts easily to 6 meters or citizen band, with tubes	$37.50
less tubes	$22.50
ARC-1, ideal 2 meter transceiver, uses 2-832A in the final and tunes automatically, 10 channel unit	$29.50
ARC-1, same as above except 50 channel unit	$49.50

POWER SUPPLIES

RA-62 AC supply for the SCR 522 but will operate ARC-3, 4, 5, etc.	17.95
Mobile wonder 12 to 24 volts rotary converter or can be used from 6 to 12 volts at 4 amps	9.95
TCS dual dynamotor power supply 12 volts in, 200 volts for receiver and 400 volts for the transmitter out complete on mounting base, filtered with starting solenoid, new	$9.95
REGULATED POWER SUPPLIES, 350 volts at 200 ma	$8.95
Teletype Rectifier, 110 volts at 2 amps	$2.95
MPN-1, 110 volts, puts out 24 volts at 18 amps, high voltage 1000 volts, new weighs approx. 100 lbs.	22.50
12 Volt DC Generators at 30 amps	ea. 4.95
24 Volt DC Generators at 25 amps	ea. 7.95

DYNAMOTORS

6 volts in, 220 volts out, 100 ma completely filtered base on 19" panel	2.95
6 volts in, 420 volts out, 280 ma	2.95
6 volts in, 620 volts out, 280 ma	3.95
6 volts in, 400 volts out, 270 ma	2.49
DM-37 24 volts, at 625 volts out at 225 ma	3.95
PE-98 12 volts SCR 522 dynamotor	6.95
12 volts in, 220 volts out at 100 ma	1.95
12 volts in, 440 volts out at 200 ma	3.95

MISC.

Telephone Hanger, small compact box with bracket for hanging handset, complete with switch	ea. $1.49
Telephone Dial, Standard	ea. $1.49
Navy Beam Filter, 1020 Cycles	ea. $1.95
2 Volt Storage Battery, 20 amp hour 5"x4"x3"	ea. $2.49
A-85A Antenna, lamp assym. for measuring output of transmitter	ea. $1.00
ARR-2 Gold plated Osc.	ea. $2.95
Automatic Keyer ARA-26, can be used to key transmitters, etc.	ea. $3.95
Remote Azimuth Indicator, consists of indicator with built in autosyn and associated selsyn	ea. $4.95
Directional Antenna, for handy talkies, etc. with instructions	ea. $1.95
Sound Powered Handsets, consisting of 2 handsets with 200 ft. of wire	per set $9.95
RM-52 Phone Patch	ea. $1.49
RM-53 Phone Patch, more elaborate version	ea. $2.49
Antenna Relay for Command set, with RF meter and Vacuum Capacitor, new	$2.25
MP-37 Antenna Mast Base	$2.49
T-45 Lip Mike	$1.49
TCS Remote Speaker with heavy duty magnet	$4.95
Carbon Hand Mike, Monarch, new, with push button	$3.95
Chest Mike	$1.49
Ultra Violet Lamp with Fluorescent lite	$1.95
Hand Cranked Generator, late type	$1.95
Geiger Counter, with Geiger Mueller tube	$4.95
Printed Circuit Board, Assortment of 10	$1.95

TECH MANUALS

SCR-536 Walkie Talkie	$2.50
BC-312 & 342	3.00
BC-1000	3.00
RT-66, 67, 68	3.50
PP-109, 112	1.50

TECH MANUALS (Continued)

SCR-625 Mine Detector	1.50
EE-8 Field Phones	1.50
BC-1335 Transceiver	2.50
APX-6 Conversion	2.00
Terminal FGC 1	2.00
BC-603 and 604 Xmttr and Rec.	2.50
TXC-1 Facsimile	2.50

SPECIAL

HOFFMAN TV REMOTE CONTROL, with motor and remote speaker, push button selector can be used for other remote purposes, complete with new motor	$6.95
HOFFMAN STEREO REMOTE BALANCE, with 25 ft. cable for balancing dual speakers remotely	$1.95
HOFFMAN REMOTE TV TUNER WITH MOTOR, with 25 ft. cable. Will operate motor and volume control remotely	$2.95

SPECIAL

X BAND HORN, 9" long 5¼x4¼ with wave guide fittings on one end. Can be made into 10,000 MC transmitter or receiver or both, new	$4.95

FOR TRADE

R-388 Collins Receiver, will trade for ?????	Value $450.00
GONSET G-150 Transceiver will trade for ????? above in 2 meter band	Value $129.50

BINARY RADIATION COUNTER, can be used with geiger or photomultiplier tube for scintillation	$39.50
TS-182, 150 to 240 MC Signal Generator with 2" scope indicator	$19.95

BC-1306 Transceiver 3500 kc to 6800 kc. Exc	39.50
TS-35 Signal Generator X Band 110 vac	34.50
TS-34 Scope, 25 to 30,000 usec, attenuator 0-24 db	35.00
TCS Modulation Transformer, 20 watt	ea. .97
Transformer, 720-0-720 at 350 to 400 ma, 6.3 vac at 14 amps	4.95
Stereo Phones, Regular 14.95, new at 9.95 pr.	
RBB Rec	
TS-84 Measurement Sig Gen, 300 to 1000 mc	97.50
Selsyns, Standard Size 110 v, 60 cy	4.95
Mega-Sweep Model 111-A	

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WE PAY ALL FREIGHT CHARGES

RECEIVERS

AN/APR-9
CV-43/APR-9 IF unit
All APR-9 Units
AN/APR-13
AN/APR-14/R-484 rec.
AN/APR-17
AN/SLR-2
AN/BLR-1 and 2
AN/TLR-1

Any and all military search receivers. Complete or individual units like ALD, ALQ, ALR, FLR, SLR designations.

TRANSMITTERS

AN/ALT-2
AN/ALT-4
AN/ALT-6
AN/ALT-8 and up

Any transmitter with ALT, GLQ, ULT, QRC, ALQ designations, tuning units.

DIRECTION FINDERS

AN/ALA-6
AN/APA-69
AN/APD-4
AN/ALD-2
AN/TRD-4 & 10

Etc. Any and all units for above.

T-230/CPN-2A xmtr
ID-17/APN-3 ind.
R-15/APN-3 rec.
APN-84

RECORDERS

AN/ALH-2
AN/ALH-4
AN/APH-2
AN/APH-4
AN/GLH-2
AN/GLH-4

Other video, audio, data recorders.

GROUND RADAR

Any and all cabinets and groups for:
AN/FPS-6
AN/FPS-7
AN/FPS-8
AN/FPS-19
AN/FPS-20
AN/FPS-88
AN/FPS-100
AN/MPS-11
AN/GPS-3 and 4
AN/UPX-4, 5, 6, 7, 8, 12
AN/UPA-22, 24, 25, 29, 35
Any and all units for FPS, MPS, MLQ, MSQ, TPQ, GPS, GLQ, etc.

GROUND RADIO

AN/GRC-3 thru 8
RT-66, 67, 68, 69, 70
AN/GRC-10
AN/GRC-19
AN/GRC-26D
AN/GRC-27
AN/GRC-32
AN/GRC-you name it
R-388
R-389
R-390A
R-220
AN/GRR-5
AN/TRC-1
AN/TRC-24
AN/TRC-36
AN/TRC-69
AN/TRC-75

Complete sets or units for above.

AIRCRAFT RADIO AND RADAR

AN/ARC-27, 33, 34, 44, 45, 52, 55, 58, 65, 67, 70, etc.
AN/ARN-21, 52, 65, 74, etc.
AN/APS-42, 45, etc.

TEST EQUIPMENT

AN/URM-25
AN/URM-26
AN/URM-27
AN/URM-44
AN/URM-48
AN/URM-52
AN/URM-61
AN/URM-62
AN/URM-64
AN/URM-70
and higher.
AN/UPM-10B
AN/UPM-44
AN/UPM-55
AN/UPM-98
AN/UPM-99

SG-1A
MD-83A
SG-13
SG-2
479-T2
HP-616
HP-618
HP-620
HP-624
HP-626
HP-628
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FM, FM, FM FOR 2, 6 AND 432 mc FM, FM, FM

MOTOROLA 150MC base stations (desk top), complete	$120.00
MOTOROLA 40-50MC base station rcvr, (rack mtg) W/ac	$45.00
MOTOROLA 40-50MC base station xmtr, (rack mtg) W/ac sup	$35.00
RCA 150MC transistorized pocket receivers, XTAL controlled, Checked out, less battery	$45.50
G.E. 40-50MC RECEIVERS, 12V, w/all tubes, pwr sup	$35.50
DUMONT 450MC TRANSCEIVERS, 6/12v, 5894 final, all tubes, schematic, conv. info. very clean. less accessories	$69.50
MOTOROLA 450MC T44A6A, 6/12v, n.b. clean, all acc	$89.50
DUMONT 150MC 5814-D, 12v "'T" power, n.b. cln, comp	$95.00
MOTOROLA 150MC, 250Watt amp., with tubes, pwr sup	$89.50
BASE STATION CABINETS, table top, sloping front panel, have provisions for 2 spkrs, meter. approx dim. 8½"H x 24"W x 17½"D. grey hammertone, w/misc switches	$12.50
MOT. 30-50MC xmtrs, all tubes, cover, less dynamotors	$10.50

ALSO AVAILABLE: MOT. B44 BASE STATIONS, 41v front mounts, 80D's, T51's, T43's, etc. also Bendix, GE., RCA etc.

FM EQUIPMENT SOLD TO LICENSED AMATEURS ONLY.

MOTOROLA 30-40MC mobiles, 12v, P8116, P8020, EASILY CONVERTED to 50MC. These are the cleanest you will ever find. mint condition, no dirt. complete with all accessories	$49.50
RECEIVER only (same as above), with all tubes, like new	$37.50
LINK 450MC base stations, enclosed rack (19") with doors, meter & speaker panel. rated 15 watts out, will do more. rcvr, luv. complete, less mike. free conversion info	$105.00
MOTOROLA 150MC transistorized pocket receivers (1961 mod.)	$95.00
LINE TERMINATION PANELS	$4.75
TONE OSC PANELS has UTC VIC-9 Variductor, less 2 tubes	$3.50
G.E. REMOTE CONSOLE 4ecl0bl, with mike	$49.50
CARTER 12V GENEMOTORS, 600V, 170MA output, like new	$12.95
G.E. 12V DYNAMOTORS, removed from G.E. 30W xmtrs. grn'td	$9.95
MOTOROLA 150MC "pocket" transmitter, 1W out. (1960 mod)	$39.50
G.E. 40-50MC XMTRS, all tubes & cover, less dynamotors	$9.95

TEST EQUIPMENT

MEASUREMENTS MODEL 80, 2mc to 400mc, mint cond	$275.00
TS497B, military version of above, mint condition	$220.00
PRECISION E-200C SIGNAL GENERATOR	$59.50
FERRIS 32A field strength meter, 550kc to 20mc	$39.50
TELETYPE PUNCH AND REPERFORATOR TEST SET AF-SAV23, with manual, like new,	$85.00
CBL 60007 CAP-RES. BRIDGE	$45.00
HEWLETT PACKARD FM MONITOR 337B, with manual	$175.00
FERRIS MICROVOLTER, 18-D 8mc to 210mc	$85.00
MEASUREMENTS MOD. 58 F-S meter, 15 to 150mc	$95.00
HICKOK 288X am-fm signal generator	$85.00
EICO 710 GRID DIP METER, ALL COILS	$19.95
TS 226A/AP UHF power meter. new	$29.50
MOTOROLA P-8500 FM TEST SET	$49.50

UHF TRANSMITTERS & RECEIVERS

HIGH POWER 1296mc transceiver. mod. dme, rated 5kw pulse, will run 150 watts out on cw. xtal controlled. Present xmf freq. is 1196mc. xmtr tube lineup: 6AH6, 5763, 2E26, 829b, 2-2C39A, 6161. made in 1961. for rack mtg. complete with schematic, less power supply	$95.00
APR-4Y AM-FM RECEIVER, 400cy, less tuning units	$85.00
RBL-3 RECEIVER, 15kc to 600kc, 110v, 60cy	$75.00
TG34A CODE OSC. with 2 rolls tape. excellent	$18.50

SEND PERFECT CW

H.O. BOEHME keying head drive (less head) with Wheatstone perforator (less cover & p/s)	$165.00
SOLA 24v, 6amp, constant voltage supply, rack mtg	$29.50
SOLA #28534, 180vdc, 4amp, lists at $345 . . . price	$45.00
XMFR, 24V, 10amp, no c.t. 110v, 60cy. new	$4.50
MULTI-ELMAC cabinets, brand new perforated cover, with punched chassis & front panel, unpainted DIM. 4½H x 11W x 8D	$3.50
MICROLAB LB-1101 UHF low pass filter, BNC's. new	$1.25
RT 279A APX6, late model, with all tubes	$25.00
MAR 225mc—400mc, xmtr rcvr, all tubes, manual, new	$39.50
BC639A, 100—156mc rcvr, with a/c supply. exc	$75.00

ARC-1 2mtr. xmtr, rcv. some small tubes missing	$17.50
URC-11 WALKIE-TALKIES, (pair) with test set. 243mc L/N	$45.00
R45/ARR-7 RECEIVER, 550kc-43mc, xclnt cond. less p/s	$85.00
BC1306 XMTR-RCVR. 2 to 6mc, with home brew ac supply, xclnt	$39.50
COLLINS 310B. needs repairs. (PTO & dial are ok)	$45.00
TELETYPE, MOD.14 PRINTER, with keyboard & sync motor	35.00
TELETYPE POWER SUPPLY, adjustable voltage, rack mtg	$8.50
COAX SWITCH, SA185, 3 type "N" connectors, new 28V	$3.65
CAPACITORS. 200 mfd, 175 volts	$0.75
8 MFD, 600V, SINGLE mtg hole, insulated from case. 3 for	$1.00
250MFD, 500V	$2.50
TECH. MANUALS for ARC-3, 36, 49,	$5.50

432MC TRANSISTORIZED PREAMP

High Q tuned circuits in both input & output for better rejection of unwanted signals. Gain 12-15DB, noise figure 5DB or better. Flexible design, may be used with future improved NPN or PNP's. BNC connectors. With schmatic & inst. (less batt) wired-tested. Satisfaction guaranteed. MAE432 prepaid $15.95

WANTED WANTED WANTED

WILL PAY CASH OR TRADE FOR COLLINS RECEIVER, R-390A, R390, R-388, 51J-3, 51J4, ETC. ALSO WANTED: BIRD THRU-LINE AND/OR ELEMENTS, ANY CONDITION.—MEASUREMENTS 65B SIGNAL GENERATOR—AN/URM-80, 81,—ARM, UPM, USM, FRR, TS, ETC. HIGH BAND FM RECEIVERS, TRANSMITTERS, TEST EQUIPMENT.—GENERAL RADIO—HEWLETT PACKARD—BOONTON TEST SETS. SP-600VLF

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minimum order 5.00 no c.o.d.'s

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SELECTRONICS SUMMER CLEARANCE

BRAND NEW PANADAPTOR PANORAMIC MODEL PCA-2 TYPE T-200

PANADAPTOR

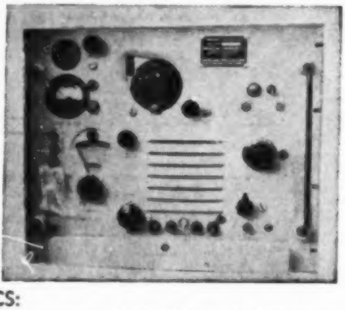
Here is another scoop by SELECTRONICS: A BRAND NEW GENUINE PANORAMIC RADIO PRODUCTS INC. PANANADAPTOR. These units are small and of a modern decor, so that they will blend with any station. They come complete with instruction manual.

SPECS:

Power Rec'd.: 115V 50-60 cycles
I.F. Range: 450-470KC
Screen Size: 2" dia.
Sweep Width: ± 100 KC to 0 KC
Tubes: 11
Size: 11"W x 6½"H x 10"D.
Shipping Weight: 20 lbs.
Price: $79.95

BRAND NEW FR-4/U/URM-79 FREQUENCY METERS

Here is a real hot item for you discriminating hams or labs who are interested in the ultimate accuracy in frequency measurements. All units are brand new in original crates with spare parts, instruction manual and two calibration books. The spare parts even include a spare crystal oven and crystals, and all tubes.



SPECS:

Frequency range: 100 KC to 20 MC (7 bands) usable to 1000 MC.

Oscillator freq.: 100 KC to 250 KC (proxy) 1250 KC (crystal), 15 to 20 KC (interpolation), 10 KC (blocking)

Frequency stability: .0001%

Accuracy: .001%

R.F. Output: 100 microvolts min. in 50 ohms

Audio Output: 2 MW min. in 600 ohms

Method of Interpolation: Visual, with built in oscilloscope

Tubes: 30

Harmonic selector: 9th thru 26th

Power Required: 115 or 230 V, 50 to 1000 CPS, 136 watts.

Weight: 146 lbs. in case

Size: 22"H x 26¼"W x 20¾"D

Description: a portable hetrodyne type frequency meter for portable or fixed use. May be removed from the case and rack mounted, or used in the case with the tilt base as a table model.

Shipping Weight: 160 lbs.

Price: $350.00

DIRECT PLUG-IN REPLACEMENTS

PREMIUM 5R4 SILICON PLUG-IN REPLACEMENT RECTIFIER RATINGS: 400 PIV @ 1 amp. D.C.

These are a direct plug-in replacement unit that will eliminate tube replacements, greatly reduce heating, and provide instant warm-up. All units ar properly compensated, potted and power tested at 1 amp. average D.C. current.
PRICE: $6.00

5U4/5Y3/5Y3GT/5V4/5V4GT/5AU4/5T4/5W4/5Z4/5AW4/5V3/5AX4/5AZ4/5Y3G (1800 PIV)

Our #SA will replace any of the above tubes.
PRICE: $1.95

80/5Z3 Our replacement #SH
PRICE: $1.95

0Z4/64 Our replacement #SE
PRICE: $1.95

EPOXY SILICON DIODES with silver leads @ 1.5 amps

50—200 V	@ .06
200—400 V	@ .14
400—600 V	@ .24
600—800 V	@ .36
800 V	@ .44
1000 or better	@ .54

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SELECTRONICS SUMMER CLEARANCE

POWER TESTED SILICON RECTIFIER
STUD MOUNT
(all 40 amps)

50 V	@ .84
100 V	@ .92
200 V	@1.94
300 V	@2.50

RG 59 A/U COAX CABLE
500' reels @ $15.00 per reel

GR—1211 75KC to 40 MC UNIT OSCILLATOR IN SIX BANDS PRICE $150.00

INTERPHONE EXTENSION KIT: two separate boxes packed in one wooden shipping crate.

Includes:

Box # 1 Telephone Box

Contains
- 1—Telephone handset with butterfly Switch & std. mike plug PL68 plus Std. phone plug (PJ055B)
- 1—Indicator Light
- 1—Control panel (Vol. control & binding posts)
- 1—Heavy duty weather proof pole mounting steel box with handset hanger

Box #2 Control & Junction Box

Contains
- 1—Steel weather proof pole mounting box
- 1—Spring loaded SPST Toggle Switch
- 1—4 pole single throw toggle switch
- 1—Indicator Lamp Ass'y.
- 2—Conduit Cable Connectors

PLUS—INSTALLATION & SPARE PARTS KIT

Contains
- 14 ft. Flexible conduit
- 35 ft. Wire
- Hardware Kit (clamps, nuts, bolts etc.)
- 4 lamps LM 44 (12-16V)
- 2 lamp lens
- 1 toggle switch
- 1 instruction & installation manual.

This unit is excellent for use outside on a Pole or Building—on the farm etc. or anywhere that outside telephones are required. Also, the handset itself is a natural for the mobile installation with the press-to-talk feature for the HAM or C. B.er.

PRICE $7.95 SHPT. WT. 86 lbs.
f.o.b. our warehouse

MODEL 19 TELETYPE SETS

Compete Mfg. by Teletype Corp.
60 speed—Some motors sync.—some governed.

INCLUDES:
- Perforator
- Transmitter Distributor
- Page Printer
- Power Supply (800 ma DC) 115V 60 cy input
- Table

These units have been checked and overhauled, and are **guaranteed** to be operable for both Printing and Tape and are in EXCELLENT condition.

PRICE $199.50 SHPT. WT. 350 lbs.
f.o.b. our warehouse

RDR RECEIVER & SPARE PARTS WITH 10 CRYSTALS

Mfg. by RCA BRAND NEW

Freq. range: 225—390 mcs.
You get two wooden crates which include:

Box #1

RDR RECEIVER with 13 V dynamotor output is 385 VDC @ 500 ma

Box #2

1—set of spare parts which includes:
- 1 Headset
- 1 Set of operating tubes (spares)
- 1 Headset extension cord
- 10 sets of fuses
- 2 pilots lights
- 1 set of connecting cables and other parts too numerous to mention.

All this in original military boxes, receiver packed in Aluminum water proof case, manual included. Easily converted to 200 mc Ham Band or use as they are for UHF aircraft band. You get all that is required to operate except the 12 VDC Source and the Antenna. BRAND NEW

PRICE $39.95 each while they last f.o.b. our Warehouse.

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All prices are FOB our Philadelphia warehouse. All merchandise described accurately to the best of our knowledge. Your purchase money refunded if not satisfied. Terms are cash. Minimum order is $5. The public is welcome to browse. We're open weekdays 8 to 5 and Saturdays 8 to 1.

RT82/APX6 makes 1215mc Xceivr. See Oct-Nov CQ.	NEW	$23.50
UPM8 Tests APX6. 27 Tubes. 10 Diodes. 115V, 60cy	FAIR	14.50
TS726/UPM8 Same as above but US reconditioned	LN	22.50
Complete Manual for TS726/UPM8. Postpaid		2.90
CG46ACQ Recvr 175-225mc. 13 Tubes include 446A's in four tuning cavities. Schematic w/parts values	NEW	27.50
Schematic with parts values for CG46ACQ Receiver		1.00
OAA-2 Radar Test Set 150-240mc. w/Schematic, Antenna, 3 tubes, 200ua Meter Indicator. 115V, 60cy	NEW	17.75
Complete Manual for OAA-2. Postpaid		1.00
Reflectometer SWR Bridge w/Meter. 30-1000 mc	EX	9.75
AM581/U General use 3 stage, 60mc IF Amplifier W/Box of spares. Coax Junction Box. Tech. Manual	NEW	9.75
AM581/U Technical Manual. NAVSHIPS 91531. Postpaid		1.90
South Wind Power Converter. Input 115V 60cy. Output 6V Amps DC or convert to 12V 10 Amps half-wave	NEW	11.75
T61A/AXT2 TV Xmtr w/Video & Sync Modulators	NEW	19.25
T61A/AXT2 Complete, unused but in poor condition.		8.75
T465/ALT7 Xmtr. 168-352mc. W/2—6161's 100W out	LN	22.50
T465/ALT7 Schematic pp 1.00 .. **T465/ALT7** Manual pp		4.65
RT220/ARN21 TACAN Modulator V-107 w/7 Tubes	EX	6.75
IP224/APS38 Sweep Amp. 1—12AU7, 1—12AX7, 2—807W	NEW	4.75
APR9 Control for switching TN128, 129, 130, 131	EX	35.00
WECO GS16741 Computer Calibrator for K-5 System w/Manual, Cables, Accessories. In Carrying Case	NEW	45.00
Same unused, complete but in poor condition		18.50
SN12B Synchronizer for APS3 & 4. W/29 Tubes	NEW	14.50
RT193/APS31 Wiring Harness with Connectors	NEW	2.50
Set of 120 Xtals Type FT243. 5675 thru 8650kc.		120/21.50
AS313B/ARN6 Station Seeking Loop Antenna	EX	4.75
TS545/UP 1150-1350mc Echo Box w/Manual, Accessory Box and Accessories. 100ua Meter Indicator	NEW	18.50
Complete Manual for TS545/UP. Postpaid		2.90
Lambda 28 Electronically Reg. Lab Power Supply	EX	18.25
Lambda 32 Electronically Reg. Lab Power Supply	EX	24.50
Ballantine 300 AC VTVM in 19 inch Rack Panel	EX	27.50
General Radio 561-D VT Bridge w/12 Plug-ins	FAIR	75.00
GR 667-A Induct. Bridge .1 Microhenry—1 Henry	FAIR	90.00
GR 1800P3 Low Freq. Multiplier for GR 1800 VTVM	LN	4.75
Dumont 256-D or **256-F** Oscilloscope. 115V, 60cy	EX	55.00
Dumont 256-D or **256-F** Oscilloscope. 115V, 60cy	FAIR	35.00
TS801/APM74 Test Set w/Indicator and Cable	EX	20.00
O-203/APQ13 Interference Simulator. 115V, 60cy	NEW	20.00
Same, unused but in only FAIR condition		15.00
UPM11A AFC Unit w/Eight Tubes, Wiring Diagram	NEW	4.50
Leeds-Northrup Model 831211 22K Precision Pot	EX	12.50
Link 1268 Multimeter w/2 Meters, 8 Ranges	NEW	14.75
R8/ARN8 75mc Recvr w/7 Tubes, 8000 ohm Relay	GOOD	4.50
MT7A Shock Mount w/Plug for one ARC5 Xmittr	EX	2.75
C45 Control Box for ARC1 and ARC12 Xceivers	GOOD	1.55
UG500/U Adapter & Connector. Wave Guide to Coax	EX	6.50
Aluminum Console 57" high. With rack for 19" x 19" Panel above Desk Shelf. Door below Shelf. Rear Door. On Casters W/115 Volt, 60 Cycle Exhaust Fan	EX	75.00
Power Supply. Electronically Regulated. 228v @ 420 ma. Solid State Rectifiers. 3—6080WA Series Tubes	LN	22.50
RF Power Supply. Oil Filled. With Schematic	NEW	12.50
Camera Simulator. Bill Jack #14132. W/Cables	LN	23.50
Localizer-Coupler w/9 Tubes, Relays, Diodes	LN	5.75
AM665A/AQS2 4-Tube Band Pass Filter Amplifier	NEW	9.25
AM818A/AQS2 8-Tube Dual Channel Amplifier	NEW	8.50
C1296/ARN9 Control Box & Instrument Mount	GOOD	4.50
TCS-12 Antenna Loading Coil	EX	7.50
C732/ARC2 Control Box for ARC2 Equipment	EX	2.25
C118/ARC3 Push Button Type Control Box	EX	3.25
C819/APA70B Control Box	EX	4.50
C633/AIC8 Radio Control (loaded wtih switches)	EX	2.25
C69/AIC2 Radio Control (more switches & a tube)	GD	2.75
C116A/ARR2 Control Box for ARR2 Receiver	EX	2.00
BC496A Dual Control Box for two ARC5 Receivers	EX	2.50
C734/APN1 11 Pos. Switch w/11 matched resistors	EX	1.75
C628 Control Box for ARC27 Equipment	GOOD	2.00
C626 Control Box for ARC27 Equipment	FAIR	4.75
C906 Control Box for ARC27 Equipment	EX	3.00
TN8/APX1 or **TN90/APX1A** Tuning Unit w/3 Tubes	EX	1.75
F245/APX25 Filter w/Cable and Connector	GOOD	1.50
MT1276 Shock Mount & Plug for R224/ARR36	NEW	3.75
MT1555/U Shock Mount for MX1394/ARC21 Keyer	NEW	2.00
CU119A Coupler w/13 1-Tube Amplifiers. W/Tubes	FR	4.75
IC/VRW7 Recorder w/Tubes & Wire. 28VDC	FAIR	6.25

PARTS...Some NEW...Some USED...ALL USEABLE

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WAC Engineering Co Model B Motor & Tachometer	EX	2.75
5876 UHF Triode in 1200mc Tripler Cavity	EX	3.75
5675 UHF Triode in 1200 mc Demodulator Cavity	EX	3.00
Preselector Cavity w/Diode. Two tuned circuits	EX	1.50
Precise HV Probe 500 Megohm 50 KV Insulation	NEW	2.50
Selsyn Indicator. 24VDC	NEW	1.00

Tubes 30¢ each: 6C4, 6AG5, 6J6, 6AU6, 6D4, 6AL5, 9004, 9006, 12SH7, 12SJ7, 12H6, 955, VR150, 2D21W, 6F8

Tubes 40¢ each: 6AQ5, 6AH6, 6AK5, 6AN5, 6X4, 6BJ6, 6J4, 6AS6W, OA2, OB2, 5687, 12AT7, 5725, 6096, 6097

Tubes 75¢ each: 6AS7, 28D7, 6F4

METERS:

Weston Model 506, 2½", 0-10VDC	NEW	2.25
Weston Model 1024, 2½", 0-200VAC	EX	3.75
Weston Model 506, 2½", 0-30V, 0-300ma, FS=100ua	EX	4.75
Weston Model 643, 3½" 0-50VDC Ext. Mount	EX	2.50
Burlington Model 921, 2½", 100-0-100ua	EX	3.25
Burlington Model 925, 2½", 0-150VAC	EX	3.75
Burlington Model 921, 2½", 0-50VDC	EX	3.00
Burlington Model 931, 3½", 0-300VDC	EX	3.00
Weston Model 843, 3", 500-0-500ua	EX	3.50
Phaostron 2½", 0-300ma	EX	2.50
Phaostron 2½", 100-0-100ua	EX	3.25
W'house Mod. RX35, 3" sq. 0-30-300ma, 3 Terminal	EX	3.25
W'house Model RX35, 3" sq, 0-30VDC, FS=1ma	EX	3.00
W'house Model NC35, 3½", db Meter	EX	4.00
W'house Model CX, 3", 0-8ADC, 0-8mv	EX	3.25
W'house Model NA35, 3½", 0-15-150 VAC	EX	4.00
W'house Model NX35, 3½" 0-150VDC, FS=5ma	EX	3.00
W'house Model RX35, 3" square, 0-150ma	EX	2.75
W'house Mod. RX35, 3" sq, 0-35KVDC (Req. Ext. Mult.)	EX	3.25
General Electric 2½", 0-1ma	EX	3.00
General Electric Model D053, 3" sq, 0-150ma	EX	2.75
GE Mod D053, 3" sq, 0-35KVDC (Req. Ext. Multiplier)	EX	3.25
Simpson 0-1-10ma (3 Terminals), FS=100ua	EX	4.25
Simpson IS-171, 0-3VDC	EX	2.00
Marion 2½", 0-50ma, 1ma Movement	EX	2.75
Marion 3½", 100ua Movement, Arbitrary Scale	EX	2.25
Triplett Model 327A, 3" sq. 0-10VDC, FS=200ua	EX	3.75
Int. Instrument Model 455, 1½", 0-1ma	EX	2.00
Roller-Smith 2½", 0-150VAC	EX	3.75
BZ7N Hummer for MCW or Code Practice	NEW	1.25
Fuse Block. Holds two 4AG Fuses	LIKE NEW	15/1.00
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Right Angle Drive w/Gears, Universal, ¼" Shaft	EX	1.75
Sprague Filteral-2 Line Filter. 10A 115V 60cy	NEW	4/1.50
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3E29 Transmitting Beam Power Tube with Socket	EX	6.50
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Collins UHF Tuner RD 5821-505-2891-FCRC	EX	1.75
Variac 3ø 120V 400 cy 2100 VA Type 60AG387	GOOD	9.50
Variac 1ø 120V 400cy 330VA Type M-2	GOOD	4.75
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Selenium Rectifier. 28 Volts @ 4 Amps output	NEW	4/1.50
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PL259 Coax Plug. Set of five, boxed	NEW	1.65
Coax Cable 6" with two UG260/U Plugs	EX	5/1.00
Coax 8" w/1 UG262A/U Socket & 1 UG260/U Plug	EX	4/1.00
Coax 2' w/1 UG254A/U Socket & 1 UG342/U Plug	EX	4/1.00
S0239 Socket EX 4/1.00. **UG290/U** Panel Socket	EX	3/1.00
M359 Elbow Connector for PL259 and S0239	GOOD	8/1.25
UG28A Coax Tee 4/1.00 .... **UG276/U** Coax Elbow		5/1.00

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Clare SK5150 6 Volt Coil 3 Amp Contacts DPDT	EX	1.00
Clare SK5151 12 Volt Coil 3 Amp Contacts 3PDT	EX	1.00
Clare SK5152 12 Volt Coil 3 Amp Contacts DPST	EX	1.00
Clare SK5153 6 Volt Coil 3 Amp Contacts 3PST	EX	1.00
Clare SG8016 or SG8017 12V Coil 3A Cont 3PST	EX	1.50
Stev-Arnold B32 24 V Coil .5Amp Contacts DPDT	EX	3/2.25
Stev-Arnold B12 24V Coil .25A Contacts DPDT	EX	4/2.25

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Potter & Brumfield MH1451 24 Volt Coil SPDT	EX	1.00
Potter & Brumfield MH1452 24 Volt Coil DPDT	EX	1.00
Potter & Brumfield MH1453 24 Volt Coil 4PDT	EX	1.25
Potter & Brumfield MH1739 24 Volt Coil 4PDT	EX	1.25
Hart 115B3T-1C 24 Volt Coil 4PDT	EX	2/1.75

RELAYS—Open Frame—Fixed Mounting

Clare CRY29973 SPDT & SPST	NEW	1.00
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Choke Audio 2X5 Henries @ 5ma 400 ohms	NEW	1.25
Choke RF 7mh 200ma 2000V Insulation	EX	3/1.00
Choke RF 2.5mh 3 pi	EX	10/1.00
Ohmite Z50 RF Choke 7uh	EX	8/1.00
Capacitor Feedthru 250 uufd 2000VDC Test	EX	4/1.00
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Teflon Ansulating Coupling 2000V Test ¼" Shaft		6/1.00
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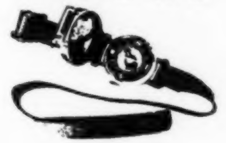

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3BZ6	.86	6AK5	1.00	6BN4	1.26	6DQ6	1.60	12AL5	.72	17AX4	1.10
3CB6	.86	6AL5	.70	6BN6	1.20	6DT6	.85	12AT6	.70	17DQ6	1.58
3DT6	.82	6AM8	1.30	6BQ5	.92	6EA8	1.20	12AT7	1.14	19AU4	1.42
4BC8	154	6AN8	1.50	6BQ6		6EB8	1.60	12AU6	.80	25AX4	1.22
4BQ7	1.50	6AQ5	.80	6CU6	1.64	6EM5	1.31	12AU7	.95	25BQ6	1.76
4BS8	1.54	6AS5	1.10	6BQ7A	1.51	6EM7	2.00	12AV5	1.64	25CD6	2.30
4BZ6	.84	6AS8	1.60	6BS8	1.50	6GH8	1.22	12AV6	.66	25DN6	2.80
4BZ7	1.54	6AT6	.72	6BU8	1.26	6J5	1.30	12AV7	1.36	25L6GT	.94
4CB6	.88	6AT8	1.60	6BX7	2.14	6J6	.87	12AX4	1.05	25W4	1.06
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5AN8	1.64	6AU5	1.80	6BZ6	.84	6S4	.94	12B4	1.10	35L6	.92
5AQ5	.88	6AU6	.79	6BZ7	1.52	6SA7	1.60	12BA6	.66	35W4	.44
5AT8	1.44	6AU8	1.60	6BZ8	1.68	6SK7	1.60	12BD6	.94	35Z5	.74
5KB7	1.36	6AV5	1.76	6C4	.64	6SN7	.96	12BE6	.66	50C5	.80
5BQ7	1.52	6AV6	.65	6CB6	.84	6SQ7	1.45	12BH7	1.10	50L6	.96

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Multi Elmac, AF-68, Xmitter, exciter, VFO, Brand new	$145.00
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Xtal. Receiver, 23.3 mc., PR6NA, New	19.00
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Heath GR-81 Recvr., 150 kc-18 mc	19.00
Hallicrafter SX-100 Receiver, 80 thru 10	95.00

MISCELLANEOUS

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Freq. Meter, 100-155 mc., BC 638-A	19.00
Wavemeter-Osc. model 1030, 145-235 mc	20.00
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DAE D.F. Receiver, 240-2000 K.C.	25.00
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F.M. Xmitter-Rec. B.C. 620, 20-27 mc	15.00
RBS-RBM, 2-20 m.c. Receiver	35.00
Power supply for RBS-RBM Receiver	12.00
ARC. 5, 2 meter transmitter	15.00
B-19 Mark II Xmitter—Rec. & supply	24.00

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Eldico TR-75 TV Xmitter, 80-10, 60 W.	24.00
TA-12 Xmitter, 160, 80, 40, 20,-90 W. 115V. supply	59.00
ARC.-1, Xmitter-Receiver for 2 Mtr.	29.00
Military HRO Receiver, with 3 coil sets	45.00
Lettine 246 transmitter, 40 Mtr.	39.00
Super-Pro 779 Receiver with 115 V. Supply	79.00
Heath VFO, 80 thru 10 Mtr.	15.00
Wavemeter—Osc. model OAP, 150-230 mc	18.00
Navy RU Receiver, with 3 sets of coils	9.00
Teletype Receiver, 11 tube, with 115 V. supply	12.00
Aircraft torpedo camera, type 1	19.00
Freq. meter 906-D, 150-225 mc	9.00
G.E. Amplifier chassis, 6 tube 25 watts	12.00
Collins PTO, 600-800 KC.	14.00
D.F. Receiver, MN-26 or BC 433	18.00
Navy type GF-11, Xmitter with 3 coil sets, less meter	9.00
M S type Ant. mast sections, #49-56 each	.50
B.C. 733-D Receiver 108-110 mc	18.00
Heath Transistorized Direction Finder	29.00
RAK Receiver, 15-600 kc. with 115 V. supply	49.00
Heath Q Multiplier	8.00
Voltage Regulator, 1 KW, Sorensen 1000-S	29.00
TBS-Transmitter or Receiver, 60-80 mc	25.00
TA-12 Transmitter 160-20 mc	24.00
Cable, RG-11/U—100 feet	6.00
ARR-2—easily converted for 220 m.c.	12.00
Brush BL-932, D.C. Amplifier	19.00
Pulse Gen., gate & delayed, #1301 BW—$9.00; Flip Flop 1101	9.00

NEW PARTS

Transformer, Pri. 230V., Sec. 3150V. DC 500 ma, 2625 V. DC 600 ma, 2100V. DC 400 ma. Approx. 100# NEW	$ 29.00
Blower, Rotron Series 320-AS, 115V Heavy duty	9.00
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Var. Capacitor, 1000V. 3 section 800/400/400 mmf.	4.95
Var. Capacitor, 2000V., 600 mmf.	4.50
Dual choke, 5.03 Hy.-600 ma., 3.48 Hy.-600 ma.	4.00
Auto transformer, 115-120V.-208-230V. 10 Amp.	4.50
Fil. Transformer 5.63 V.C.T., 14.5 Amp. & 5.35V C.T. 13 Amp.	$ 4.95
Fil. Transformer 6.4V.-6.6 Amp., 6.1V.-3.5 Amp.	3.95
Transformer 5.1 volt @ 15 Amp.	3.50
Drawer slides, 22½" when closed, extends 25" external. Heavy duty, pair	2.50
Variac 400 cycle, 7 Amp.	5.95

Oil condensers			Electrolytic		
10 mfd.	600V.	$1.00	9000 mfd.	12V.	$1.50
4 mfd.	1000V.	1.00	6000 mfd.	10V.	1.00
4 mfd.	10000V.	4.00	5000 mfd.	50V.	2.00
4 mfd.	600V.	.75	4000 mfd.	18V.	1.50
25 mfd.	400V.	2.00	250 mfd.	450V.	2.00
5/5 mfd.	400V.	1.00	8 mfd.	600V.	1.00

Output transformer, Pri. 5000 ohm, Sec. 500 Modulator, 600 ohm side tone	$ 1.00
Resistors, 4000, 5000, 6000, 9000, 10000, 14000 ohm, 100 watt, $1.00; 200 watt	1.50
Resistors, 2 ohm, 2.5 ohm, 300-500 watt	1.00
Non-Inductive Globar Resis. 15 or 20 ohm, 50 watt	.50

Power Supplies, etc.

Elmac M-1470, 12V. & 115V. 150 or 225V. 70 ma 400 or 500V. 175 ma	$ 24.00
Power supply chassis, 3000V. CT—300 ma	19.00
Babcock PS-1B, 115V. AC-330V.-240 ma.	20.00
Elmac 6V., 250V.-90 ma.	9.00
Ameco PS-3, 600V.-150 ma., 300V.-100 ma, 12V.-3 Amp. or 6.3V.-4 Amp.	24.00
Teletype supply RA-87, 115V. AC-115V. DC	9.00
Lambda PS-33 regulated 100-200V.-300 ma 6V. C.T. 5 Amp.	25.00
Supply Chassis, 600V. & 400V.-200 ma	9.00
Hammarlund Super-Pro. 115V. supply	14.00
TCS 12V. Dynamotor supply, 400V.-180 ma, 220V. 100 ma	9.00
PE-103, 6 or 12V.-500V.-160 ma	8.00
Leece-Neville 6V. ..... $25.00—12V.	40.00
RCA 10D/3501, 500V.-400 ma, 180V.-240 ma, 180V.-60 ma & 12V. brand new. Approx. 100#	35.00
Supply—500V.-280 ma, 310.-180 ma, 12V.-2 Amp., 12 V. Bias, new	24.00
Supplies—630 V.-230 ma.—$15.00; 900V.-300 ma.	15.00

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DECEMBER 1965
for uses 'n' hookups.

FACTORY TESTED **SEMI-KON-DUCTORS**

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☐ 4 2N336 NPN SILICON transistors, Transistron $1
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☐ 4 "TEXAS" 20 WATTERS, 2N1038-1042, w/sink $1
☐ 4 2N170 TRANSISTORS, by GE., npn for gen'l rf $1
☐ 6 TRANSISTOR RADIO SET, osc-ifs, driver-pp .. $1
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☐ 10 PNP SWITCHING TRANSISTORS, 2N 404, TO5 $1
☐ 10 NPN SWITCHING TRANSISTORS, 2N338, 440 $1
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☐ 4 2N117 TRANSISTORS, npn silicon, TO22 ... $1
☐ 10 FAMOUS CK722 TRANSISTORS, pnp no test $1
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☐ 3 2N706 500MW, 300MC NPN PLANAR, TO46 . $1
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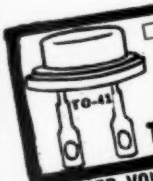

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2N1073A
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15 Amps
80 – 120 V

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☐ 3 For $1

Volts	Volts	Volts	Volts	Volts	Volts	Volts	Volts	Volts
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☐ 7.5	☐ 11	☐ 16	☐ 24	☐ 36	☐ 51	☐ 75	☐ 110	☐ 160
☐ 8.2	☐ 12	☐ 18	☐ 27	☐ 39	☐ 56	☐ 82	☐ 120	☐ 180
☐ 9.1	☐ 13	☐ 20	☐ 30	☐ 43	☐ 62	☐ 91	☐ 130	☐ 200

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Includes
- Transistors
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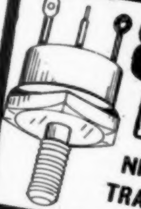

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NEW for '66

40 mc

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SILICON RECTIFIERS

PRV Volts
Max. Rect. DC Output Ma
6000
200

3000 piv 200 ma
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.500" dia. x ½" l.

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☐ 7-Amps		☐ 16-Amps		☐ 25-Amps	
PRV	Sale	PRV	Sale	☐ 300	1.75
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AMPS	25 PIV	50 PIV	100 PIV	200 PIV
3	☐ 5¢	☐ 7¢	☐ 12¢	☐ 19¢
15	☐ 15¢	☐ 22¢	☐ 40¢	☐ 65¢
35	☐ 39¢	☐ 50¢	☐ 75¢	☐ 1.19
AMPS	400 PIV	600 PIV	800 PIV	1000 PIV
3	☐ 25¢	☐ 35¢	☐ 45¢	☐ 69¢
15	☐ 90¢	☐ 1.35	☐ 1.59	☐ 1.79
35	☐ 1.90	☐ 2.50	☐ 2.75	☐ 2.95

750 MIL TOP HAT AND EPOXIES

PIV	Sale	PIV	Sale	PIV	Sale
50	☐ 5¢	600	☐ 19¢	1400	☐ 95¢
100	☐ 7¢	800	☐ 29¢	1600	☐ 1.10
200	☐ 9¢	1000	☐ 51¢		
400	☐ 13¢	1200	☐ 69¢		

DELCO ☐ HIGH POWER $1

PNP 100Watt/15Amp HiPower TO36 Case! 2N441, 442, 277, 278, DS501 up to 50 Volts

☐ *Bidirectional Transistors** C101
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☐	40 "TINY" RESISTORS, 1/10W, 5 % too!	$1
☐	10 TRANSISTOR SOCKETS for pnp-npn transistors	$1
☐	30 MOLDED COND'S, mylar, porc, black beauty	$1
☐	50 ONE WATTERS, resistors, asstd values, 5% too	$1

100's SOLD AT 4:95 TRANSISTORS

☐ 100 for 2.98

POWER, RF, IF, AUDIO, SWITCHING
no test

GERMANIUM AND SILICON GLASS DIODES

100 FOR ☐ $1.49
untested

TRANSITRON TBS20 $1.49 ☐

SILICON BI-SWITCH
7 amp 200 piv.
used in AC phase control and lamp dimmers.

10 WATT STUD ZENERS

Worth $ 8.50
Each $1.00

Volts	Volts	Volts	Volts	Volts		Volts	Volts	Volts
☐ 6.8	☐ 10	☐ 15	☐ 22	☐ 33	☐ 47	☐ 68	☐ 100	☐ 150
☐ 7.5	☐ 11	☐ 16	☐ 24	☐ 36	☐ 51	☐ 75	☐ 110	☐ 160
☐ 8.2	☐ 12	☐ 18	☐ 27	☐ 39	☐ 56	☐ 82	☐ 120	☐ 180
☐ 9.1	☐ 13	☐ 20	☐ 30	☐ 43	☐ 62	☐ 91	☐ 130	☐ 200

500 Mc SILICON PLANAR PANCAKE POWER TRANSISTORS

(ACTUAL SIZE)

☐ similar to Fairchild

	DISS	V	GAIN	
	Watts @25C <1w	V_{CE}	@Ic Ib	
			h_{FE}	ma
2N3303 NPN	3	12	30-120	1000

ONLY $1.49

10¢ FOR OUR GIANT BARGAIN CATALOG ON: ☐ Semiconductors ☐ Poly Paks ☐ Parts

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TERMS: send check, money order, include postage—avg. wt. per pak 1 lb. Rated, net 30 days. CODs 25%

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COLLINS R388

COLLINS COMMUNICATIONS RECEIVERS

I have been selling Collins Communications Receivers for better than ten years. Because my standards are very high, I had to price these sets at proportionately high levels and relatively few are aware of my service in this field. I offer for sale the finest variety of the best communications equipment available in the United States, and in quantity. My prices vary approximately $400 for a poor grade R388 to almost $2000 for the best grade R391. These receivers are all built around Collins permeability tuned oscillators (PTO), a device which in itself is a marvel of electro-mechanical engineering.

Collins introduced a radical departure in communications receivers in the year 1948 with the introduction of their 75A1 receiver. Amateurs may remember that this receiver defied convention at the time and opened up a whole new field for Collins. This device, in effect, had a crystal controlled front end and a variable tuned IF. By using relatively low frequency variable oscillators, Collins was able to vastly improve upon the stability of the communications receivers available at that time. Their 75A2, 3, 4, produced in the tens of thousands, were to become world famous in the amateur field.

It is not generally realized, however, that back in 1950, this same concept was incorporated into a general coverage receiver known as the 51J. The 51J covered the range of 500 KC to 30.5 MC. It did so with an overall accuracy of better than a kilocycle and provided a means for accurately tuning any CW, MCW, or AM signal within its frequency range. In the early days, these receivers were very much sought after by every branch of our Government who used such gear and they became the means for extensive monitoring by the FCC. The 51J went through a logical series of changes ending with the J4 which incorporated a mechanical filter. Its predecessor, the 51J3, was widely reproduced as the military R388 and became known to countless amateurs as well.

By 1955, the first of the R390 series had been produced. This was a heavier, more rugged, receiver of somewhat radical design. Likewise general coverage, it provided for digital read-out and a

HERBERT W. GORDON COMPANY

Woodchuck Hill, Harvard, Mass., 01451
Telephone 617-456-3548

higher order of accuracy and stability over the range of 500kc thru 32MC. It was also a mechanical marvel and this model was purchased by the thousands by the military for use in point to point work and discrete frequency surveillance.

A somewhat less complicated version without voltage regulation was introduced about the year 1958 and known as the R390A. Versions which provided for remote tuning of up to seven channels were the R391 and for light weight limited applications, R392.

The R389, on the other hand, may be roughly compared with the R390 except that it covers the range of 15 KC through the range of 1500 KC and was obviously a particularly good receiver for the study of Doppler effect and reception of long wave signals. This set, like its sister, was a mechanical marvel even more so, however, in that it incorporated automatic band change and a refined servo system as well.

When we obtain these receivers, we painstakingly overhaul and rebuild them until the standard of performance is equal to or greater than the original specified performance. Particular attention is paid to the PTO and, if possible, the PTO's of these sets are replaced with rebuilt units available from Collins.

The degree with which the receiver provides linear operation over its range determines its price. Other features contributing to price are appearance and the degree of tracking from one megacycle range to another. With reference to the 51J (R388), as an illustration, it is interesting to note how our standards apply and determine the ultimate selling price. Assume for this illustration, that the receiver has been turned on for at least 10 minutes and that the dial has been set to an even megacycle mark. Set the fiducialy or hair line at the exact center of the calibrated bezel. Turn on the calibrating switch and set the BFO to zero beat. Now, without touching the BFO control or the calibrating switch or for that matter any other control, tune the KC knob clockwise until the beat note will be observed at the extreme 500 KC point at the right of the dial. You will note a deviation error. Write down this error in KC or cycles and now rotate the main KC knob to the other extreme of the dial and observe the error at the left end of the main dial. The sum of these two errors will be known as the maximum deviation error in cycles in KC per megacycle. A very excellent set will have a total deviation error of less than 2 KC and such a set is worth between $750 and $1000. With the deviation error between 2 and 3 KC, the value of the set will range between $600 and $750; when the deviation ranges between 3 KC and 4 KC (the maximum allowable limit), the value of the set may be stated between $450 and $600. If the deviation is greater than 4 KC, the oscillator must be replaced and a new, or rebuilt, assembly obtainable at a cost of $190 from Collins be installed.

Now go back to the first part of this test and leave everything established for an even megacycle mark such as 2 mc. Observe the zero beat and then rotate the megacycle switch knob to an adjacent odd megacycle such as 1 or 3 mc. Then slowly tune the KC knob until the new zero beat has been obtained. Measure this difference as an error. For the best sets, this error will be less than 1 KC. For errors in excess of 2 KC, the value of the complete receiver has to be reduced proportionately.

The very best sets are those which meet these specific tests and whose appearance comes closest to being like new. It must be presumed that sensitivity and other performance factors will be equally high.

The specific range in price on the R389's varies from $700 to $1200; on the R390, from $1000 to $1400; on the R390A, from $1000 to $1500; on the 391, from $1200 to $1600. All of these sets are guaranteed and supplied with instruction manuals and adequately packed for shipment to any part of the world and are available in quantity. Do not hedge. These are the best quality communications receivers made in the world. They have no peer. Even Collins' latest sets do not excell in quality and except in size and in weight, there is nothing made today that can equal the outstanding performance of these communications receivers. Those interested should write for specific information and quotations. Herb Gordon W1IBY

HERBERT W. GORDON COMPANY

Woodchuck Hill, Harvard, Mass., 01451
Telephone 617-456-3548

TS-134/UPM1

A high quality oscillator wave meter with BC221 type dial, calibrated in hundreds and units, completely assembled with 9006 diode and coaxial output available at $5.00 each. It covers a range of 460-570 mc. May be used for indicating resonance.

CAVITY OSCILLATOR

O-13/UPM-1

Complete with built-in attenuator giving up to 120 DB attenuation, this high quality unit is furnished with coaxial cable and covers a range of 460-570 mc priced at $9.70 each.

TEST SET TS-26/TSM:

1000 ohms per volt, 2% accuracy, used as either a voltmeter or ohmmeter. As a voltmeter it reads 3 V, 30 V, 300 V, and 600 V. As an ohmmeter—R x 10, x 100, and x 1000. Has special scales for the measurement of capacity and originally was made for measuring losses in spiral four telephone cable. Approximately 50 pieces available priced at $20.00 each.

AMPEREX 5867:

Made in December 1965, this is a very lately designed triode intended for single sideband grounded grid application. Normally $30.00—A very limited number of these are available at a special price of $21.00 each. Filament 5 v at 14.1 amps. Mu = 25 (gain of 100). Max plate dissipation 250 watts. Max plate voltage 3000 v. Max plate current 363 ma. Max output in watts 840. Max grid current 69 ma. Max freq for full ratings 100 mc.

RCA MODEL 508:

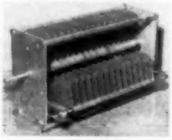
New Dynamic microphone, high impedance with 20' of shielded microphone cable, chrome plated, frequency response 200 cycles to 8000 cycles, excellent for ham use. RCA's price better than $39.95, my price $15.00 each while they last.

MOTOR DRIVEN VARIAC: MODEL W10D16CK-S2.

Brand new merchandise, 30 pieces available subject to prior sale. General Radio's price better than $100 apiece, my price $49.95. This unit will enable you to remotely control a standard 115 V 10 ampere variac. This is the latest type of GR product with Duratrak construction, individually packaged, and furnished with instructions.

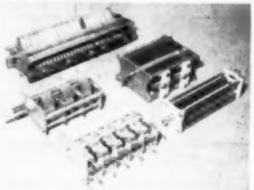
VOLTAGE REGULATOR

7500 watt, made by Sola in Chicago. Here is a brand new article capable of regulating any input voltage from 190 to 260. 1 Phase Secondary voltage would be 230 V at up to 32.6 amperes with 90% power factor, Sola's catalog #5060. It is rated at 7500 VA at 60 cycles. The unit weighs 1200 lbs, it is 50" high x 24" wide x 15" deep. Sola's price today better than $1000.00, my price $450.00.



VARIABLE CAPACITORS:

Excellent for use in sideband 2 KW linears is the Johnson 325C70 which has a rating of 325 MMF at 700 V with a .175 air gap. My price special at $9.00. Here is a superb value.



3-Section Variable Capacitor: 365 PF per section, 5" long x 3¼" wide x 2" high, plated brass, bakelite insulation, ball bearings, and ¼" shaft with 5 to 1 reduction/gear, Catalog #2000E35 priced at $4.95.

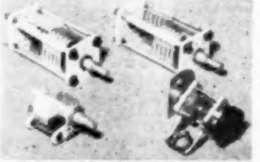
5-Section Air Capacitor: 365 PF, 6" long x 3¼" high x 2" wide, end plates measure 2¾" x 3¼" with ⅜" shaft, ball bearings, ceramic insulation, excellent for loading capacitor in 2 KW final—priced at $7.00.

General Electric Air Capacitor: 20—440 PF, 7" long x 2 x 2 x 2, ceramic end caps, with ¼" shaft, heavy brass construction, .015 spacing, very fine for loading capacitor or general work—priced at $4.00 each.

Dual Capacitor: 25 PF 030 spacing, counter balanced type (see illustration). Measures 3½" long x 1½" x 1½" with ¼" shaft, heavily silver plated, very fine for ham VHF work—priced at $1.50 each.

Hammarlund Dual Capacitor: 210 PF per section, spacing .1", measures 5" long x 4½" high x 2½" wide, heavily plated brass with ¼" shaft—priced at $4.20 each.

Cardwell Special Dual Condenser: 210 PF and 110 PF with .250 spacing, measures 10½" long x 4" wide x 2¼" high, silver plated, with ¼" shaft—priced at $6.50 each. Suitable for switching in extra capacity on 160 or 80 meters final tanks.



Miniature Philco Tank Circuit: (See illustration). VHF/UHF unit, consists of 1 turn, silver plated, #12 wire mounted on split-stator of 20 PF per section. Rigidly mounted on ceramic end plates with sprocket-wheel end assembly for fixing position of capacitor. Slot type knob mounted on ¼" shaft—priced at $1.00 each. Suitable for 2 meter tanks.

HERBERT W. GORDON COMPANY

Woodchuck Hill, Harvard, Mass. 01451
Telephone 617-456-3548

Standard Dual Bearing Miniature Condenser: Straight line wave length capacitance, 100 PF, .01" spacing, measures 1¾" x 2" x 1⅛" with ¼" slotted shaft. An extremely fine general purpose variable, heavily plated, at a special low price of 90¢ each.

VITREOUS ENAMELED RESISTORS

Ohmite, Electrohm, Truohm, and others—
Brand New Merchandise
Fixed Unless Otherwise Indicated

Ohms	Quantity	Watts	Price
7.5	13	20	25¢
120	5	30	40¢
800	7	60	50¢
1K	7	60	50¢
1.2K	7	60	50¢
100	25	80	50¢
200	22	80	50¢
310	24	80	50¢
314	26	80	50¢
400	27	80	50¢
500	21	80	50¢
630	27	80	50¢
800	18	80	50¢
1K	21	80	50¢
1.2K	17	80	50¢
1.6K	19	80	50¢
2K	20	80	50¢
2.5K	20	80	50¢
3.1K	25	80	50¢
4K	22	80	50¢
5K	19	80	85¢
6.3K	24	80	85¢
8K	23	80	85¢
[illegible]	14	80	85¢
12K	25	80	85¢
16K	25	80	85¢
25K	21	80	85¢
40K	22	80	85¢
25	6	100	Variable $1.00
50	17	100	$1.00
100	8	100	$1.00
125	15	100	$1.00
250	40	100	Variable, $1.00
500	4	100	Variable, $1.00
100	8	150	$1.35
150	22	150	$1.35
250	13	150	$1.35
25K	24	150	$1.35
5	245	200	$1.95
10	470	200	$1.95
10 (non-inductive)	4	200	$1.95
100	240	200	$1.95
150	410	200	$1.95
250	148	200	$1.95
500	4	200	(9 taps) $1.95
1000	60	200	$1.95
1500	25	200	$1.95
2K	14	200	$1.95

All checked prior to shipment—Compare our price

TRANSFORMERS AND CHOKES:

American Transformer Co. Filter Reactor, 5" x 6" x 4¼", type PB R.M.S., test 205 KV. DC Oper. 0-5 KV. DC = 65 ohms, 120 cycles ripple. Induced test 400 KC @ 180 cycles, 5 H @ 0.30 amperes DC, 25 H @ 0.03 amperes DC, Spec #32268—priced at $4.00 each.

Palmer 10H @ 250 MA, 3¾" x 3¼" x 5" with ceramic terminals. Priced at $2.50 each.

Raytheon Smoothing Choke, type UX8589, 25 H @ .095 MA DC, tested 1780 V, 3" x 3 1/3" x 4"—priced at $1.25 each.

Raytheon Smoothing Choke, type U8822A, 10 H @ 0.15 amperes DC, Res 139 ohm, tested 1780V R.M.S., 3¾" x 3¾" x 3¼"—priced at $1.50 ea.

STC #124C3, 6" x 5½" x 4½", 15 H @ 250 MA DC—priced at $2.75 ea.

Westinghouse Filer Choke #L-386944, 10H @ 225 MA DC, 77 ohm DC Res 500V insulators, 4¼" x 4½" x 3½"—price $2.00 ea.

Freed Power Transformer Co. #12479, 5" x 4½" x 4", primary 115V AC, secondary 350-0-350 @ 120 MA + 6.3V @ 4 amps, + 5V @ 3 amps, price $3.10 ea.

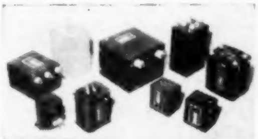
Raytheon Filament Transformer #UX-9247, primary 115V AC, 60 cycles, secondary 6.3V @ 5.1 amps + 6.3V @ 1.2 amps, tested 1780V R.M.S. Price $2.00 ea.

Modulation 50 watts 7000 Ω to 4500 Ω

RCA Transformer, Dwg 104959, Spec 4229, 3½" x 3" x 2½", black crackel finish, 4 reg terminals at end numbered 4-7, DC resistance of 6 & 7 = 45 ohms (10 MH), 4 & 5 = 10 ohms, 5 - 2 = 100 ohms, 1-4-3 = 100 ohms (1-4=50 ohms & 3-4 = 50 ohms)—price $2.00 ea.

RCA Modulation Transformer, Dwg 110344, spec 5236, 3500 ohms to 4000 ohms, 100 W, 4¼" x 4" x 3½", black crackel finish, price $4.00 ea.

Audio Co. Transformer, #A5482-B, 5½ x 5½ x 4, primary 0-115V AC (Taps @ ± 10%), secondary 390-0-390V @ 180MA + 6.3V @ 1A + 6.3V @ 7A + 5.0V @ 3A + 5V @ 2A, price $4.00 ea.



Chicago Transfer #6459A Transformer, 6" x 5" x 4¾", primary 105-110-115--120-125V AC, secondary 625-0-625 V @ 240MA, price $4.00 ea.

UTC (Special Series) Filament Transformer S71, 5½" x 5½" x 4¾", primary 0-105-115, secondary 2.5V - 12A + 2.5V (CT) + 2.5V (CT). Price $3.00 ea.

Raytheon Selenium Transformer, 4½" x 4" x 3½", type UX9115A, primary 115V @ 60 cycles, test 1780V R.M.S., secondary 42.5V/11 @ 2 amps, test 1780V R.M.S., can be used to produce 28 - 48V at 2 amps with suitable bridge, price $2.59 ea.

Westinghouse Power Transformer L426506, 1 phase 60 cycles @ 115V AC in. 68 VA 1-2 = 115 primary 3-4-5 = 660V (CT @ 330V) @ .080 amps, 6-7-8 = 5V CT, 2.5V @ 3.0 amps, 5" x 5" x 3¾", price $3.00 ea.

RCA Output Transformer, Type 900885 (CRV 30528), primary rating 5000 ohms, DC = 120 ohms, 1-2-3 = CT, secondary #1 500 ohms (modulator) 20 ohms DC terminals #8-9, secondary #2 200 ohms (side tone), 5 ohms DC terminals 4-5-6-7, circular body 2" dia, end plate 2¾" x 2¾", price $2.10 ea.

NEW OIL FILLED CAPACITORS
(paper)

Capacity	VWKG.	Size	Manufacturer		
8.0	600 DC	1¼"x3¾"x4¼"	Sprague	CP70BLEF805K	$1.25
8.0	600 DC	1¼"x3¾"x4¼"	Aerovox	CP70ELEF805	$1.25
8.0	600 DC	1¼"x3¾"x4¼"	Sprague	CP70ELEF805	$1.25
10.0	600 DC	1¼"x3¾"x4¼"	Sangamo		$1.50

Brand new R-175 National Company RF chokes at a fraction of their cost. Only $1.50.
Tons of surplus of all description. Write us your needs.
Massachusetts residents add 3% sales tax. All shipments FOB Harvard. Parcel post extra.
When in the vicinity drop in and browse around. Try out the newly announced models. See our extensive used equipment room.

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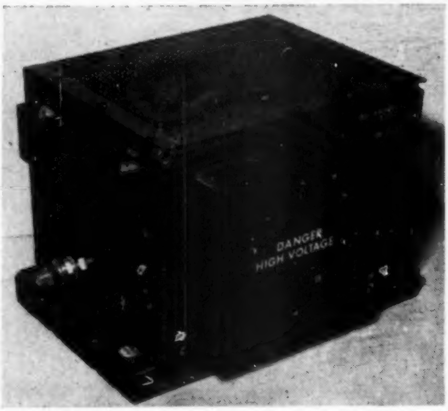
MOBILE TRANSCEIVER POWER SUPPLY:



Limited number of brand new RCA SSB-5 DC power supplies intended to operate in motor vehicles having a negative ground. The set operates on 12V DC, is a transistorized lightweight unit, very ruggedly constructed, and capable of furnishing the following voltages:

+ 800V at up to 300 MA
+ 300V at up to 200 MA
− 100V at up to 25 MA
+ 12V at up to 5 A, specially filtered.

Here is a supply worth over $300.00 which provides extremely good regulation and low impedance output. The weight of the unit is eight pounds, and the supply measures 7½" high x 11" wide x 7½" deep. Supplied with schematic and instructions for use at $65.00.

PARTS KIT:

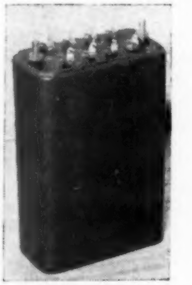
We are offering a kit of parts for making an AC power supply to furnish 800 V at up to 400 MA, 300 V at up to 300 MA, 125 V at up to 25 MA, and 12.6 V at up to 6 amperes. This supply when finished by you will measure 13½" long x 6⅝" high x 5¼" wide. It is meant to operate on either 115 V or 230 V, 60 cycles and is furnished complete with schematic and instructions at the price of $65.00. This is a kit; the DC supply mentioned above is completely wired.

These supplies were intended originally to be used with RCA SSB-5, a very expensive 125 watt sideband transmitter-receiver. We have these left over from our recent sale and offer them to the public on a first come, first-served basis. There are approximately 25 of each available. They are excellent for the normal run of transceiver such as Swan, Drake, Collins, etc.

GONSET G76 DC SUPPLY:

12 volt transistorized DC supply with cable. Just 13 of these brand new supplies available at $49.95 each. Gonset number 3350. Produces 700 v plus 300 v. A remarkable value. Intended originally for powering the famous G76 AM rig. A rusky rugged unit well worth your consideration. Negative ground only.

PHONE PATCH KIT:



We are offering to our amateur friends a very high quality phone patch kit complete with a special hybrid transformer shown in the illustration. This transformer has four 600-ohm windings. It is a specially shielded job and so wound as to produce the least amount of hum. This kit is furnished with instructions, the transformer, the switch, the RF chokes, the special condensers, and attenuating resistors for the price of $5.95. The transformer alone is worth over $60.00. We have approximately 50 of these kits available for sale.

HERBERT W. GORDON COMPANY

Woodchuck Hill, Harvard, Mass., 01451
Telephone 617-456-3548

DOW TRADING COMPANY

FLEXIBLE COUPLINGS 1/4 to 1/4 inch shaft hole.	3 for $1
TCS DYNAMOTORS 12 v DC input, 400 v dc at 200 ma output	$3.95
J-38 telegraph key. New	$2.95
HEADPHONES 17000 ohms impedance. Trimm commercials	$5.95
METERS 1″ square 0-1 ma dc	$3.25
METERS 3″ round 0-100 ma dc	$2.95
METERS 2″ round 0-500 ua	$3.50

WE CARRY AN ALMOST COMPLETE LINE OF STACO TYPE VARIACS

CIRCUIT BREAKERS small type.	$1.95
HOBBY MOTORS 115 vac or dc	1.95
RG-58/U 52 ohm coax. 100 feet.	$4.75
ALLEN BRADLEY 2 watt pots.	50¢ each, 3 for $1.25

WE HAVE MANY TYPES OF TOGGLE SWITCHES AND JEWEL PILOT LIGHTS

ISOLATION TRANSFORMER 1000 watt, 115 v.	$19.95
TRANSFORMER 36 volts, 5 amps.	$ 3.95
TRANSFORMER 36 v at 2 amp and 6.3 v at 1.5 amp and 100 v at 30 ma.	$ 2.95
CHOKE 11 hys at 300 ma. 125 ohms.	$ 2.75
4-150A SOCKETS	3 for $2.00

CONDENSERS

8000 mfd x 50 vdc	$1.50
1500 mfd x 50 vdc F.P.	.50
45 mfd x 350 vdc plug in.	4 for $1.00
45 mfd x 450 vdc plug in.	3 for $1.00
10 mfd x 600 vdc oil filter	.75

RELAYS

DPST coil 115 vac plug in	$1.25
DPDT Sigma. coil 8000 ohms	$1.85
DPDT coil 6 vdc Alsamag Inc.	$1.85
8PDT coil 12 vdc telephone type. Removed from new equipment.	$1.25

DOW TRADING COMPANY, INC.

2057 E. HUNTINGTON DR. • DUARTE, CAL. 91010 • 357-3763

Don Hansen W9ZZH
2143 North 70th Street
Wauwatosa, Wisconsin 53213

Ohmmeters

Ohmmeters, devices for rapidly measuring dc resistance, are simple instruments. Of the many types, series and shunt ohmmeters using d'Arsonval movements will be discussed.

The basic circuit for a series ohmmeter is shown in **Fig. 1**. A linear d'Arsonval movement in series with a battery and external resistance comprise the basic series ohmmeter. The meter has series resistance R_M and the battery has series resistance R_B and voltage rise E. A resistor of unknown value is connected across the terminals of the ohmmeter and completes the circuit. The deflection of the meter is a function of the resistance of R_x. If the circuit components are fixed, the meter can be calibrated directly in ohms. The values of E, R_B, R_M, and R are selected so the meter indicates full scale with the input of the meter shorted ($R_x = 0$). With the input of the meter open (R_x approaches infinity) the circuit current is zero. As a result, the series ohmmeter has a non-uniform scale with zero resistance at the right and infinite resistance at the left.

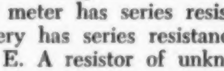


Fig. 1.

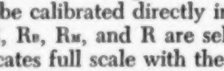


Fig. 2.

The sum of the resistances R_B, R_M, and R is the internal resistance of the ohmmeter. The sum can be represented as R_S. If a value of R_x is selected so its resistance is equal to the resistance of R_S, the meter will indicate midscale. The internal resistance of any series ohmmeter is equal to the midscale value marked on the scale.

The basic circuit for a shunt ohmmeter is shown in **Fig. 2**. The shunt ohmmeter derives its name because the unknown resistance R_x is placed in shunt with the meter. A complete circuit exists, even with R_x disconnected. Therefore, switch S is provided to eliminate battery drain when the instrument is not in use. The values of E, R_B, R, and R_M are selected so the meter indicates full scale when R_x is disconnected (R_x approaches infinity). When R_x is equal to zero, the meter current is zero because the meter movement is shunted by a short circuit. As a result, the shunt ohmmeter scale is the reverse of the series ohmmeter. Like the series ohmmeter, the shunt ohmmeter scale is also non-uniform.

The equivalent internal resistance R_P of the shunt ohmmeter is

$$R_M+R+R_B$$
$$R_P = R_M(R+R_B)$$

If a value of R_x is selected so its resistance is equal to the resistance of R_P, the meter will indicate midscale. The internal resistance of any shunt ohmmeter is equal to the midscale value marked on the scale.

As the battery in either the series or shunt ohmmeter ages, its internal emf (E) and series resistance (R_B) change. The series and shunt ohmmeters to be practical, must have an adjustment to be made before the instrument is used and to compensate for battery aging. Resistor R is made variable to accomplish these adjustments.

When the battery emf and resistance change, R can be adjusted to partially compensate for the change. Since the adjustment affects only the internal resistance and not the emf, the meter calibration still becomes in error as the battery ages. Most commercial ohmmeters have been designed to limit the amount R can be changed to hold the error to a reasonable value.

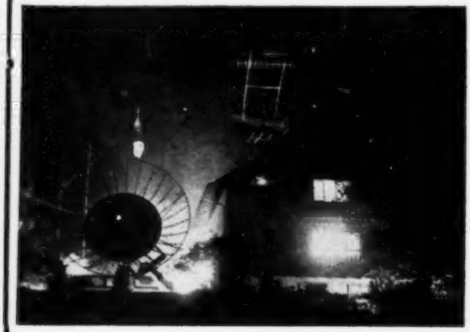
Ohmmeters are among the simplest and easiest to use devices for measuring resistance. Most commercial ohmmeters are made as part of multimeters or VTVM's. Every shack should have an ohmmeter as part of its repertoire of test equipment.

. . . W9ZZH

(Continued from page 2)

The next morning I drove down to Stuttgart and spent the day walking around that beautiful city and taking pictures. That night I had dinner with DJ1BZ, DL4SS and DL4SZ at the famous television tower restaurant which stands high on a mountain overlooking the city. When we left we found a QSL from HB9PL stuck on DL4SS's windshield indicating that Peter had been there to visit the observation platform above the restaurant. He of course had no way to know that I was there.

Ed, DL9GU, who had talked with me at the Frankfort dinner, had phoned ahead to HB9RG and the group was waiting for me when I arrived at Zurich. I left my car to have its 300 mile oil change and Hans drove me to HB9RF's house up in the mountains. DJ3EN Kurt had come down from Germany with Al W7AUR/DL4 for the gathering and the five of us sat around all afternoon talking and taking pictures. Is seemed very remarkable to me to find this little group of amateurs way up in the Swiss Alps with their dish antenna and old VW bus full of gear they had built. Even more remarkable are the contacts they have made with it on 432 mc and 1296 mc across the Atlantic ocean. How small our world is to amateur radio. Here I was sitting talking with these fellows about Sam and all the others that I know who are interesting in moonbouncing. It was exactly the same as talking with the gang down in Massachusetts or in Arecibo. A couple of months later I was on the Arecibo end of a moonbounce 432 contact with this same group.



Later Hans, Al, Kurt and I drove on to the HB9RG home, high on another mountain, working HB9RF all the way with a Gonset two meter Sidewinder. After a delicious dinner we contacted stations as far as Hannover, some 600 miles north. Around midnight Kurt and Al headed back for Germany and I slept over in the spare room. Ham radio has warm friendships wherever I go in this world.

DX alarm

Now I don't know about you, but I would find it handy if there was some frequency that I could check into now and then to find out if there is any rare DX around the twenty meter band. My usual practice is to turn on the receiver and tune carefully up from 14200 listening for any pileups. This doesn't always work for pileups are often quiet while the DX station is transmitting, though, unfortunately not always, and it is not difficult to tune right over one of the rarest stations and not even know that I've missed him.

What I propose is this . . . see if you like the idea. The next time I scout a rare one I'll zip on down to 14273 when I'm through and make a general announcement for anyone listening. If enough of us follow this procedure I think we'll find that a lot of fellows will just leave their receiver tuned to that channel waiting for an alarm. Also, when first coming on the band we might use this channel as a check in to see what has been going on. If you keep your remote VFO on this channel when you're not using it to work the low end you can just switch automatically on there and sound off.

What do you think? All those in favor see me on 14273. All those opposed write in and complain. All others forget I mentioned it.

W2NSD/1 schedule

For a year now I've been intending to set up some sort of schedule frequency and time so those of you with questions about anything can ask them in person. Anything except business matters, of course. If you have any questions about your subscription please write a postcard, don't call me on the air.

The problem is that first of all I am wretchedly forgetful and have a long history of missing schedules by about 40 minutes or so. I remember them up until a half hour before sked time, then next time it crosses my mind is an hour or so later...and in some cases a week later, very embarassing.

With this limitation in mind, I'll set up tentative schedules to be on 14273 at 0000 GMT. You'll find me around 14230 or so in the mornings frequently at 1200Z and often afternoons around 2000Z. At these times I'm usually looking for DX and would prefer to be called only if something is really important.

I'll be away during May, but should be around a bit during June and July. August and September I'll be away again.

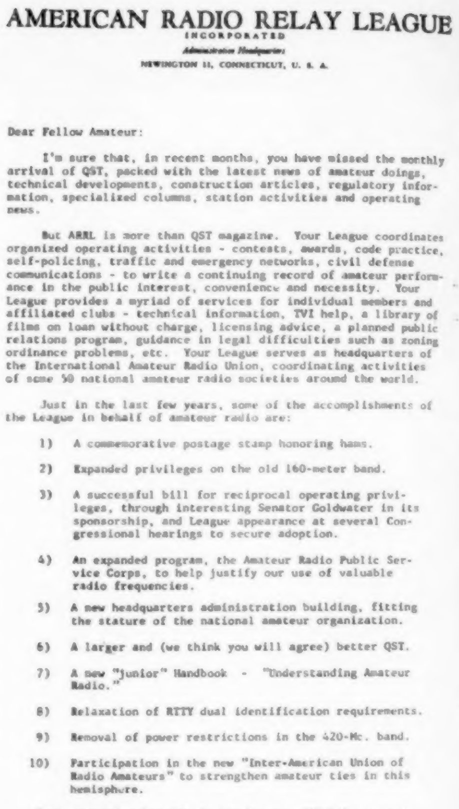
"I don't agree with everything you say . . ."

On the air . . . at conventions and at club meetings I am often met with this phrase. My jovial answer is that I should certainly hope they wouldn't agree with everything. My private opinion is that either they have not read my editorial very closely or else I have failed to get across my idea.

Many fellows say they want facts to back up what I say. This is possible in some cases, but in others this comes hard. For instance, when I point out to you the league is floundering around with no definite plans for the preservation of our hobby I am giving you an assessment that is difficult to document.

You can, if you are interested, check into anything I say for yourself. I know of no one who has taken this interest who has found my evaluation in error or even distorted. For instance, to find out where the League stands on providing leadership through the International Amateur Radio Union all you have to do is talk with the heads of a half dozen national radio societies in Europe and a few of the top boys in the Americas. If this is too much trouble, then read the RSGB Bulletin, the REF Bulletin, DARC and others. The ARRL stands condemned.

Before anyone goes accusing me of lying or distortions I think they should spend the 10¢ postage for a copy of the Huntoon letter to the National Convention Committee in which he enumerates 28 instances where he claims I have lied or distorted facts in my editorials. This is our official record of the claims against my editorials by the one person who should best know where I have made any mistakes about the ARRL.



AMERICAN RADIO RELAY LEAGUE
INCORPORATED
Administration Headquarters
NEWINGTON 11, CONNECTICUT, U. S. A.

Dear Fellow Amateur:

I'm sure that, in recent months, you have missed the monthly arrival of QST, packed with the latest news of amateur doings, technical developments, construction articles, regulatory information, specialized columns, station activities and operating news.

But ARRL is more than QST magazine. Your League coordinates organized operating activities - contests, awards, code practice, self-policing, traffic and emergency networks, civil defense communications - to write a continuing record of amateur performance in the public interest, convenience and necessity. Your League provides a myriad of services for individual members and affiliated clubs - technical information, TVI help, a library of films on loan without charge, licensing advice, a planned public relations program, guidance in legal difficulties such as zoning ordinance problems, etc. Your League serves as headquarters of the International Amateur Radio Union, coordinating activities of some 50 national amateur radio societies around the world.

Just in the last few years, some of the accomplishments of the League in behalf of amateur radio are:

1) A commemorative postage stamp honoring hams.

2) Expanded privileges on the old 160-meter band.

3) A successful bill for reciprocal operating privileges, through interesting Senator Goldwater in its sponsorship, and League appearance at several Congressional hearings to secure adoption.

4) An expanded program, the Amateur Radio Public Service Corps, to help justify our use of valuable radio frequencies.

5) A new headquarters administration building, fitting the stature of the national amateur organization.

6) A larger and (we think you will agree) better QST.

7) A new "junior" Handbook - "Understanding Amateur Radio."

8) Relaxation of RTTY dual identification requirements.

9) Removal of power restrictions in the 420-Mc. band.

10) Participation in the new "Inter-American Union of Radio Amateurs" to strengthen amateur ties in this hemisphere.

Your renewed membership in the League will help support projects like these and more to come.

Perhaps most important, the League is the representative of the amateur in national and international regulatory fields. This work is vital to our existence, and particularly so with the world in its current turmoil. Even if you are currently inactive, chances are you have plans to get back on the air at some future time. Your membership in the League, with that of others who may be inactive, will help insure that the amateur bands will continue to be available. The more support the League has, the more effective we will be. We would like to have you back on the membership roster again, and send QST to you each month. What say? 73,

Sincerely yours,

John Huntoon, W1LVQ
General Manager

The Huntoon letter is one of the biggest mistakes that John has ever made. In my answer to his letter I take each of the 28 complaints about my editorials and show how he has distorted his criticism, or lied. As an example of the Huntoon letter, he writes that I show "complete ignorance of League structure and affairs." To back this up he writes, "He (me) states, 'The primary activity of the ARRL is to publish QST, the Handbook and other assorted publications.' In fact, the purposes of the League are spelled out in its Articles of Association, where publication activity is mentioned only as the last one of 8 major ob-

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jectives dealing with the enhancement of and representation for amateur radio."

Please not the sly change there. I said "primary activity" and Huntoon answered "purpose." Now, from what Huntoon says I think you can see that something has gone all wrong with the purposes of the League for there certainly is no question whatever about publishing being their primary activity. This is one of the simplest facts to substantiate you could ask for. A copy of the ARRL financial statement is available at no charge to all ARRL members for the asking. If you take a few minutes to sort out this maze of figures you will begin to see what is going on. Just total up the expenditures that reasonably seem to be publishing expenses. Then total up those that look like expenses for league services other than publishing. This works out to be about 90% for publishing and about 10% for non-publishing.

Taking the last available financial statement in hand you will find that the Board of Directors was responsible for a mere 2.7% of the total expenditures of the League. I'll leave it to you as to whether John is guilty of trying to confuse the issues here by changing the subject to "purpose" instead of activity.

Did I pick an isolated example to answer here? Not at all. Every one of his answers are just as devious and distorted.

You should know that Huntoon has flatly refused to face me in front of any club and that the only time in history that he did face me he read from a prepared text and refused to answer any of my questions. I stand ready to face him and answer his questions if he will answer mine. This is a challenge that I have made before and which he dares not accept.

If you find that Huntoon or any of the ARRL Directors are going to speak to your club I suggest you send for a copy of the reprint of Huntoon's letter and my answer so you can ask intelligent questions of your speaker. Do not be surprised if they answer by getting mad and stalking out . . . this has been their only reply so far. It is up to you to make the League officials face the mess they have created and let them know that they can't go on fooling everyone with pontificial prepared speeches and pious generalities. It is up to you to pin them down. Demand to know why the League does not have a lobby in Washington and don't accept any evasions about the League counsel down there supposedly "representing" you. He represents the League before the FCC and cannot legally approach a Representative or Senator with regard to any Congressional legislation. Demand that Directors' meetings be fully reported and that the secret pre-board meetings be stopped. Demand that full information about salaries for top paid employees be made public and full information about the incredible retirement pay be revealed. Members certainly have a right to know where their money is going. Demand that the yearly financial statements be published in QST along with detailed explanations of major expenditures.

Wayne Green blowing hot air again you say? OK, those of you who have dropped out of the League recently have received a letter signed by John Huntoon listing ten accomplishments of the League in behalf of amateur radio in the last few years. This letter is the most incriminating of all. It is a blatant admission of the almost complete lack of value of the League to amateur radio. What does Huntoon list as the first and foremost accomplishment of the League in the last few years? #1. A commemorative postage stamp honoring hams. This is indeed a true memorial to the League: The Purple Botch. Remember that this was voted by stamp collectors as one of the worst stamps of the year and few hams will argue the point.

Perhaps Huntoon is being modest for the League and the other nine accomplishments are more noteworthy? #2. is expanded privileges on 160 meters. This is nice . . . it is a great accomplishment. How many of us has it benefited? Maybe a hundred? OK, maybe two hundred at the outside. That is a pretty poor showing for the number two accomplishment of the League in recent years. #3 is the reciprocal licensing bill. Whoa, fellows. Sure, you pushed it, finally, but you held it up for several years when others were trying hard to get support for it. After several years you finally stopped fighting it. This is like Russia taking credit for the defeat of Japan in WWII. #4 is the Amateur Radio Public Service Corps. Let me ask a foolish question . . . how many of you have any idea what the ARPSC is? #5 is the new headquarters building. This is an accomplishment of the League in behalf of amateur radio? #6 is a larger and better QST. I don't know how it is better, but if you'll check the size you'll find it has skinned down by about 16 pages over the last two years. #7 accomplishment is the publication of "Understanding Amateur Radio." #8 is nice, the relaxation of RTTY dual identification requirements. Several hundred hams benefit from this major step ahead. #9 is power restriction removal on 420 mc. A dozen hams benefitted, maybe three dozen. #10 is reaching way into the bag . . . participation in the IARA.

I am sure that all of us are justifiably proud of that list of accomplishments.

Don't forget to send that large self-addressed envelope with 10¢ in stamps for the Huntoon letter and my answer. Find out where the lies are coming from once and for all.

SSB Contest

Though I'm as an inveterate rag chewer as anyone . . . ask XW8AX about the longest QSO he's ever had (over an hour) . . . there is something fascinating about contests. During the 24 hours of this contest I managed to work 492 stations in 90 countries (206 prefixes). Not bad for a poor-man type ham station with just a little old kilowatt and a tiny three element beam up against the big guns with up to ten kw and six over six beams, etc. Last year only Don Miller operating K2HLB (a very very big big gun) did better in the U.S.

Looks like Don won again this year . . . for the whole world. Perhaps he got piqued at the tremendous advantage DX stations have in this contest. At any rate he sat it out on a small lump in the Pacific called Minerva Reef using the home brew call of 1M4A. The last I heard he had almost 2000 contacts and lacked only 1M4 for working all prefixes. I played it cool and let him work 1200 more eager stations before trying to break through the QRM and thus got him right off when I tried.

Outside of Don there wasn't much rare DX around in the contest. EA8AH came on for a couple minutes, heard the explosion and "went to dinner." I think this same thing happened to most of the others. They are gun shy now and find other things to do on contest weekends. It was a field day for any G, D, SM, etc., that wanted to fill a few shoe boxes with U.S. QSL cards. I'm not sure I understand the fascination of this . . . and, as I said before, I don't know why I enjoy the whole procedure.

No July hamfest this year

Our hamfest was a lot of fun last year and we thought we might make an annual affair out of it, but I'm going to be away from here too much to really put on a good show so we have decided to put it off this year and see if we are in better shape next year.

During May I will be visiting Stockholm, Helsinki and Oslo. Late in the month I'll be out at Anaheim for the convention. In June and July I'll be getting ready for the safari in Africa. This means shots for everything imaginable, visits to consulates for all of the countries we will visit for visas and, if possible, ham licenses, shipping stuff over we'll be needing, plenty of target practice with my new Weatherby 300 Magnum gun, etc. I sure wish you were all coming . . . what a trip we'd have!

Paul will be away part of the time too. He's going over to see Europe in June. He's doing a fine job of editing 73 and certainly rates the vacation.

WTW vs DXCC

Both Gus and I realize what we are undertaking with the establishment of the 73 Worked The World award. Rather than mount a ten year to get the League to make the changes in their DXCC award which would better meet the present day needs of amateur radio, we have decided to go ahead and make the award available under our own steam.

We know that a large part of the activity in amateur radio is a product of the DXCC award. The award is almost completely responsible for all of the DXpeditions we have been seeing so frequently of late. It is mostly responsible for the mountain of QRM that makes life miserable for operators in rare countries.

But when you have something as integral to amateur radio as this award you have a mandate to keep it up with the times and not let it get thirty years out of date. I believe that the basic drawbacks of DXCC which we have overcome with WTW will eventually swing amateur radio into acceptance of this more up to date award.

First and foremost CW ops want to count their CW countries and phone ops want to count their phone countries and never the twain shall meet. WTW issues separate certificates for phone and CW and keeps a complete set of records for the two modes. The two will be listed separately in 73.

Secondly, each amateur band is a separate identity and it is like mixing apples and eggs to count 160 meter countries with the same credit as 20 meter countries. WTW issues separate certificates for each amateur band. This means that 75 meter ops are in competition with 75 meter ops and 10 meter ops with 10 meter ops in the country race. These will be listed separately in 73.

Thirdly, how can a newcomer even hope to get a high place on the QST honor roll? It is solidly topped by old timers who got many of the hard ones years ago. WTW requires that you work a country at least once every five years to continue to keep credit for it. This means that an enterprising newcomer can make his way well up into the country totals at any time. It also means that the old timers are going to have to keep plugging in there to hold their place.

Then there is the sticky question of what is and what is not a country. The League list is a mass of contradictions of any set of rules you care to state and has led to a good deal of hard feelings. Our solution to this is to accept all of the ARRL designated countries, plus those of recognized amateur radio societies around the world. The French society certainly should be an expert of what French possessions count as countries, etc. If some spot is so obviously not a country that no national society will recognize it as such, then it just won't count.

As the advantages of WTW over DXCC become better known I expect that it will become more popular. In the meanwhile both Gus and I will appreciate it If you will talk up WTW on the air. If you have any questions about tne award please drop Gus a line via 73, Peterborough, N. H. 03458.

Another ARRL blunder? At least.

The word has been going around that the League may change its mind about giving credit for Ebon Atoll and Cormoran Reef. Chuck Swain was sailing around the Pacific Ocean putting rare "countries" on the air to give fellows DXCC credits and he checked with the League before going to Ebon to make sure that it would count for DXCC before making the dangerous journey. Chuck was lost at sea along with Ted ZL2AWJ a few weeks later on their way to activate another ARRL DXCC country. If the League now decides to discount Ebon I think they deserve a scroll for the outstanding bad sportsmanship of the year. . . . Wayne

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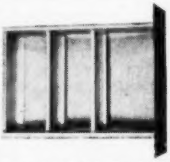

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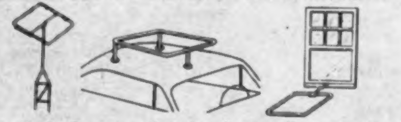

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INSTRUCTOGRAPH, 110VAC, 60 cycle, with oscillator and tube installed in case, complete with ten code tapes and instruction book. Bought new for $51.75. Used very little. Sell for $35. Will deliver anywhere on east coast between Boston and Philadelphia area I travel. Write: JPR, PO Box 504, Westport, Connecticut.

SX 101-3-4—matching speaker $150.00 pick up only. Martin Rexsen WEFEI 493 Oxford Road, Cedarhurst, N.Y. 11516. Tel. 516-Ce 9-2411.

HAMMARLUND HQ-110A. Excellent condition and in original carton. $160 or a trade of good VHF gear. Frank Wargocki WA3AYW, 2602 Orthodox Street, Philadelphia, Penna. 19137, Phone 215-743-4251.

HT44 $210. PS150AC $70. SX117 $250. All power and transceive cabling, manuals, and original shipping cartons. Guaranteed like new condition. Photo and or sked on request. Shahan W5END 4110 Knotty Oaks, Houston, Texas, TEL ID3-2944.

FAULTLESS DRAKE TR-3 for sale. Complete with AC-3/MS-3 and DC-3. All in excellent condition—like new. $575.00 for everything. Gary Goldberg WA2FAS, 221 Clark Street, Hillside, N.J. 07205.

FOR SALE APR-4 receiver tunes 39-4000 Mc. Panadapter APa-11 pulse analyzer, 6 meter transceiver. Peter Donneau W1YIX, 11 Blanche Ave., Cumberland, R.I.

NEW 55 AMP Delco Remy Alternators and Regulators from 1965-66 Oldsmobiles. $35.00 per set. Bob Bevington (K5BFQ), 509 Hardin, Blytheville, Ark.

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SILVER PLATING: It may cost far less than you expect, to have your tank circuits silver plated. Address inquiries to: Jim Knapp WA2KIQ, Knapp Electroplating Co., P.O. Box #154, Wayne, N.J. 07470

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COMPRESSION AMPLIFIER for sale. P & H AFC-2 with 4th tube factory modification and instruction book. Excellent. $35.00. George G. Scott W2LFX, 6 West Stuart Drive, Glen Cove, N.Y.

WANTED Goldkit Thriller or Nurseman Transceiver. Box 97, Wilmington, N.C.

WANTED British EL37 DX transmitter. Cheap. Box 41, Wilmington, N.C.

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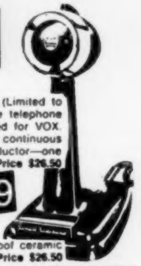

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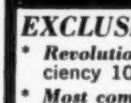

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